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REPORT OF THE PRESIDENT OF THE CARNEGIE INSTITUTION.[1]

IN compliance with the provisions of article IV. of the by-laws of the Carnegie Institution of Washington, I have the honor to submit the following report on the work of the institution during the fiscal year ending October 31, 1905, along with recommendations of appropriations for work during the succeeding year, and with some suggestions concerning the future course and progress of the institution.

Coming as the writer has to the presidency of an institution already well organized, but still in the earlier stages of its development, it is essential for the purposes of a report to assume as a point of departure the plan and scope of operations found well under way. Accordingly, the résumé of the work of the year given below is an account of work planned substantially by the executive committee of the preceding year. Similarly, the recommendations made with respect to the ensuing year are mainly in accord with the lines of policy hitherto followed by the executive committee. The additional experience of this year seems to confirm, especially, the wisdom of concentrating the resources of the institution on a small number of large projects rather than on a large number of small projects. Concerning this

[1] From the 'Year Book' for 1905.

mooted question, however, some observations will be found in a later section of this report. As regards the larger aspects of the work of the institution, this report aims to give only a few suggestions derived from a preliminary reconnaissance of the fields of activity already entered. A survey of these fields, not to mention other promising fields of activity, will obviously require more than the available time of one year.

Existing Plan, Scope and Mode of Administration of the Institution.

As a matter of record, and as a matter of information to the general public, which takes an enlightened interest in the affairs of the institution, it seems desirable to explain briefly, in this connection and at this epoch, the plan, scope and mode of administration of those affairs. Referring to the articles of incorporation and by-laws, published on pages 1–8 of the 'Year Book,' for a full statement of the objects of the institution and the rules adopted for its administration, the fields in which its activities are now concentrated may be summarized under four principal heads, namely:

1. Large projects, whose execution requires continuous research, usually by a corps of investigators, during a series of years. Ten such projects are already under way.

2. Small projects, which are usually carried on by individual experts during a limited period of time. About three hundred grants in aid of such projects have thus far been made.

3. Tentative investigations, carried on by young men and women who have shown aptitude for research and have desired to pursue specific problems for one or two years. A limited number of persons have been aided by the institution in this line of work in the hope that some of them might develop exceptional abilities.

4. Considerable sums of money have been allotted annually for the publication of meritorious works which would not otherwise be readily printed, and for the publication of the reports and results of the investigations carried on under the auspices of the institution. This promises to be a fruitful field of activity. About forty volumes of works in diverse fields have already been issued.

Briefly described, the administration of the institution is vested in a board of trustees, which meets annually. During the intervals between the meetings of the board of trustees, the affairs of the institution are conducted by an executive committee, chosen by and from the trustees, acting through the president of the institution as chief executive officer.

Financial Statement for the Year 1904–5.

The following table shows the balances brought forward from previous appropriations; the amounts appropriated for the year 1904–5 by the board of trustees at their meeting of December 13, 1904; the revertments during the year; the totals available for expenditure during the year; the allotments for the year, and the unallotted balances for large grants, minor grants, research assistants, publication and administration, respectively:

	Unallotted Oct. 31, 1904.	Appropriation, Dec. 31, 1904.	Revertments, Oct. 31, 1904, to Oct. 31, 1905.	Total.	Allotments.	Balance Unallotted Oct. 31, 1905.
Large grants	$4,250.00	$310,000	—	$314,250.00	$304,500.00	$9,750.00
Minor grants	230.68	148,000	$6,692.33	154,923.01	130,625.00	24,298.01
Research assistants	—	20,000	—	20,000.00	10,400.00	9,600.00
Publication	24,683.49	40,000	4,474.73	69,158.22	29,388.15	39,770.07
Administration	18,195.59	50,000	150.00	68,345.59	36,868.92	31,476.67
Totals	$47,359.76	$568,000	$11,317.06	$626,676.82	$511,782.07	$114,894.75

The following list shows the departments of investigations to which the larger grants were assigned and the amounts of those grants:

Station for Experimental Evolution	$ 12,000
Tortugas Marine Biological Laboratory	15,700
Desert Botanical Laboratory	6,000
Horticulture	10,000
Economics and sociology	30,000
Terrestrial magnetism	25,000
Historical research	14,000
Solar observatory	150,000
Geophysical research:	
A. L. Day	15,000
G. F. Becker	7,500
F. D. Adams	1,500
Nutrition:	
F. G. Benedict	7,500
T. B. Osborne	4,000
R. H. Chittenden	2,500
L. B. Mendel	2,000
Paleontology (transferred to minor grants)	1,800
Total	$304,500

The fields of investigation to which the minor grants were assigned, the names of the grantees, and the amounts of the grants are shown in the following list:

Anthropology:	
Dorsey, G. A	$ 3,000
Archeology:	
Pumpelly, R.	26,000
American School of Classical Studies:	
Athens	2,500
Rome	2,600
Astronomy:	
Boss, L.	6,000
Campbell, W. W.	3,000
Davis, H. S.	1,500
Newcomb, S.	2,500
"	5,000
Bibliography:	
Index Medicus	10,000
Botany:	
Cook, O. F.	2,000
Spalding, V. M.	600
Swingle, W. F.	1,500
Lloyd, F. E.	500
Chemistry:	
Bancroft, W. D.	1,000
Baskerville, C.	2,000
Baxter, G. P.	1,000
Jones, H. C.	1,000
Morse, H. N.	1,500
Noyes, A. A.	2,000
Richards, T. W.	2,500
Geology:	
Chamberlin, T. C.	6,000
Willis, Bailey	2,475
History:	
Wright, J. M.	250
Phillips, U. B.	300
Haskins, C. H.	1,000
Paleontology:	
Case, E. C.	800
Hay, O. P.	1,800
Wieland, G. R.	1,500
Philology and linguistics:	
Flügel, E.	7,500
Hempl, G.	1,000
Scripture, E. W.	2,700
Physics:	
Barus, C.	1,000
Burgess, C. F.	2,500
Wood, R. W.	1,000
Woodward, R. S.	3,000
Nichols, E. L.	1,000
Zoology:	
Castle and Mark	600
Howard, L. O.	3,000
Marine biological laboratory	10,000
Naples zoological station	1,000
Tower, W. L.	1,500
Pearl, R.	1,250
Duerden, J. E.	750
	$130,625

The following table shows the fields of investigation, the names of research assistants, and the amounts of their grants:

Field of Investigation.	Names of Research Assistants.	Amount of Grants.
Anthropology	Jones, W.	$1,000
Botany	Olive, E. W.	1,000
Chemistry	Sill, H. F., and Zerban, Fritz	1,000
History	Scott, G. W.	1,200
Physics	Whitehead, J. B.	1,200
Zoology	Lutz, F. E.	1,000
	Shull, G. H.	1,000
	Johnson, R. H.	1,000
	Morse, A. P.	1,000
Total		$10,400

The sources and the amounts of the revertments during the year are as follows:

REVERTMENTS FROM NOVEMBER 1, 1904, TO OCTOBER 31, 1905.

Minor grants:		
O. P. Hay, from large grants	$1,800.00	
Southern and Solar Observatory, grant No. 70	657.38	
Archives United States Government in Washington, grant No. 28-B	984.12	
E. S. Shepherd, grant No. 176.	250.00	
R. S. Woodward, grant No. 282	3,000.00	
G. Stanley Hall, grant No. 61.	.83	
		$6,692.33
Publication:		
W. O. Atwater	$1,900.00	
J. W. Baird	8.25	
W. W. Coblentz	474.91	
H. S. Conard	679.22	
J. E. Duerden	251.40	
H. S. Jennings	10.85	
A. P. Morse	27.85	
George H. Shull	51.89	
N. M. Stevens	64.60	
A. C. McLaughlin	1,005.76	
		4,474.73
Administration:		
300 copies publication No. 16 University of Pennsylvania		150.00
		$11,317.06

RÉSUMÉ OF WORK OF THE YEAR.

The Larger Projects.

One of the tasks the president has undertaken is that of conferring personally with all investigators at work under the auspices of the institution and inspecting all laboratories, observatories or other establishments where projects of the larger type are under way. Since there have been about three hundred and sixty men and women at work under grants during the past year, and since they reside in widely separated localities, it has been impossible to complete this task in the three hundred days thus far available for the work. Nearly all of the more important establishments have been visited, however, and conferences have been held with nearly all of the investigators.

Considering the wide range and the technical character of the researches of these investigators, it would be presumptuous to attempt in a general report anything more than a summary of their work, and this summary may be brief, since the reports of individual investigators, which will be found on pages 51–52 of the 'Year Book,' are designed to give all needed details.

Specially worthy of mention in this connection are the ten larger projects now under way. Without seeking to designate them by inelastic terminology, for they are in a process of development, they may be classified departmentally as shown in the following list, which gives also the names of the principal investigators conducting these works of research:

Experimental evolution in biology: Charles B. Davenport.

Marine biology: Alfred G. Mayer.

Desert plant biology: D. T. MacDougal and F. V. Coville.

Horticulture: Luther Burbank.

Economics and sociology: Carroll D. Wright.

History: Andrew C. McLaughlin and J. F. Jameson.

Geophysics: F. D. Adams, George F. Becker and Arthur L. Day.

Nutrition: F. G. Benedict, R. H. Chittenden, L. B. Mendel and T. B. Osborne.

Solar physics: George E. Hale.

Terrestrial magnetism: L. A. Bauer.

Of these departments of research, four have semi-permanent quarters constructed or under construction by the institution. These are the Station for Experimental Evolution in Biology at Cold Spring Harbor, Long Island, N. Y., in charge of Professor Charles B. Davenport; the Marine Biological Laboratory at Dry Tortugas, Fla., in charge of Dr. Alfred G. Mayer; the Desert Botanical Laboratory at Tucson, Ariz., at present in charge of a non-resident committee of advisers, Dr. D. T. MacDougal and Mr. Frederick V. Coville, and the Solar Observatory now under construction on Mount Wilson, near Pasadena, Cal., and in charge of Professor George E. Hale. Although these departments are barely started, and necessarily require additional time for the formative stages, they are

already producing noteworthy results and need only the energetic application of patience and persistence to insure contributions to knowledge of prime importance.

Biological Investigations.

The observational and experimental work undertaken in animal and plant biology is of a fundamental character, and is contemplated, it is thought, according to a scale adequate for the solution of the very difficult problems presented. The systematic study of these for a series of years can hardly fail to yield results of signal practical and theoretical value. Several publications with reference to these investigations have already been issued and others will soon be ready for publication. The advantages for research in botany and zoology afforded by our biological stations are attracting the attention and stimulating the activity of eminent investigators. Several of the leading zoologists of America availed themselves during the past summer of the facilities for the study of marine fauna afforded by the laboratory at Tortugas, Fla. Similar use has been made of the opportunities presented by the station at Cold Spring Harbor, N. Y.; while the Desert Botanical Laboratory, by reason of the novelty and the probable economic importance of its work, is an establishment of profound interest alike to the scientific and to the general public.

Horticultural Experiments.

The horticultural experiments and the remarkable achievements of Mr. Luther Burbank are well known in a popular way, though it must be said that the more important aspects of his work remain yet to be interpreted to men of science as well as to the interested public. Owing to the impracticability, during the past year, of securing the services of a trained biologist, the preparation of a scientific account of the ways, means, methods and results of Mr. Burbank's work has been delayed. He has continued his experiments, however, as related in his report, and it is hoped that the necessary arrangements for securing the scientific account of his work contemplated by the board of trustees will not be long deferred. Little short of five years will be required for this work if it is done thoroughly well.

Department of Economics and Sociology.

As will be seen from the report of Dr. Wright, the department of economics and sociology has undertaken a comprehensive project which should bring, in a few years, extensive contributions to the social and economic history of the United States, and probably also equally important data for a forecast of American social and economic development. The goal of science is capacity for prediction, and although economic and social science are still sometimes regarded as somewhat 'dismal' in comparison with the older science of astronomy, for example, they are plainly destined to play an increasingly important rôle in the progress of mankind.

Department of Historical Research.

The department of historical research, which was one of the first to be organized under the auspices of the institution, has attained an assured position of prominence and approval in the historical world. Under the energetic direction of Professor Andrew C. McLaughlin, this department has stimulated historical research to a noteworthy degree. The publications issued under his editorship have been widely read by students and by investigators, and the demand for historical papers and documents issued and discovered by the department is constantly increasing. It is with regret that the executive committee has been called upon to accept the resignation of Professor McLaughlin, to take effect at the end of the current fiscal year. His re-

port for this year will be found in the 'Year Book,' and attention is invited to the summary he gives of the work of the department up to date. Professor McLaughlin has been succeeded by Professor J. Franklin Jameson, formerly professor of history in the University of Chicago.

Geophysical Research.

Work in geophysics has been carried on independently by three investigators, namely, by Professor Frank D. Adams, at McGill University, Montreal, and by Dr. George F. Becker and Dr. Arthur L. Day, of the U. S. Geological Survey. Briefly characterized, their researches aim to determine the modes of formation and the physical properties of the rocks of the earth's crust. We may confidently expect that the results of these researches will be of great economic as well as of great theoretic importance. The conditions of occurrence of rock constituents and materials, including the precious metals, appear now essentially discoverable by means attainable in the laboratory.

Certain kinds of rocks have already been made artificially, and the making of others is only a question of time and the application of available resources. Publications already issued and in press from this department of work are furnishing remarkable contributions to our knowledge of the properties of matter, alike of interest and value to the theoretical physicist and to the practical engineer.

Investigations on Nutrition.

Some degree of novelty, it may be said, attaches to the investigations into the physics and chemistry of human nutrition carried on by Professor F. G. Benedict at Wesleyan University, Middletown, Conn.; by Professors R. M. Chittenden and L. B. Mendel, at Yale University, New Haven, Conn., and by Dr. T. B. Osborne, of the Connecticut Agricultural Experiment Station, at New Haven, Conn. The details of these investigations are far too numerous and technical to permit adequate description here. Summarily, however, it may suffice to state that Professor Benedict is making experiments on men similar to the experiments made by mechanical engineers on steam-engines and power plants to determine their physical properties and efficiencies. An apparatus has been devised whereby man as an engine, or power plant, may be studied as carefully and as conclusively as any other mechanical plant. An account of this apparatus and of the results to be expected from its use will soon appear as No. 42 of the publications of the institution. Professors Chittenden and Mendel, on the other hand, are studying the chemical and physiological processes and effects in man arising from the qualities and quantities of foods he consumes; while Dr. Osborne is engaged in an exhaustive determination of the chemical properties of that large group of foodstuffs known as proteids. The prospective value of these researches admits of no doubt; and in addition to their direct bearing on the human economy, in health and disease, they possess a peculiar interest arising from the fact that the instruments of investigation are also the objects of research.

The Solar Observatory.

Of the larger projects undertaken by the institution the solar observatory ranks first in order of cost for initial construction and equipment. This cost, however, is no more than commensurate with the magnitude of the problem attacked, namely, that of the physical constitution of the sun and his rôle in the solar and stellar systems of the visible universe. The work of construction and equipment of the observatory has been pushed forward with great energy and efficiency during the year, so that the establishment may be expected to be nearly if

not quite complete by the end of another year. Through the courtesy of the University of Chicago, the Snow telescope of the Yerkes Observatory has been mounted and been in constant use at the solar observatory during the past summer. This three-foot reflecting telescope has already furnished excellent results and justifies the sanguine expectations entertained with regard to the five-foot reflector now nearing completion. The unusually favorable atmospheric conditions which prevail day and night at the site of the observatory have attracted the attention of astronomers and astrophysicists generally. During the past summer a party under the direction of Professor S. P. Langley, secretary of the Smithsonian Institution, has been there observing data for the solar constant; while Professor E. E. Barnard of the University of Chicago, has utilized the peculiar facilities of the site by installing the Bruce telescope of the Yerkes Observatory and extending his remarkable photographic charts of the Milky Way.

Department of Terrestrial Magnetism.

Not very remotely allied to the work of the solar observatory is the work of the department of terrestrial magnetism, though the utility of the latter is perhaps more apparent than the utility of the former. All of the sciences, however, like the phenomena of nature, are more or less interrelated, and this is especially the case with solar and terrestrial physics. There is no doubt, at any rate, that solar activity and terrestrial magnetism are in some degree related. Since the publication of the investigations on terrestrial magnetism by the illustrious Gauss, during the first half of the nineteenth century, comparatively little progress has been made in either theory or practise until within the past decade. It is but just to remark that the recent fruitful renewal of activity in this line of work is due chiefly to the enterprise and energy of Dr. L. A. Bauer, in charge of the department of terrestrial magnetism. The execution of the plan he has outlined for a magnetic survey of the oceanic areas, as well as of the land areas, can not fail to secure data of signal value alike to marine transportation and to magnetic theory. By means of specially devised instruments and apparatus, as explained in Dr. Bauer's report, the department has demonstrated the practicability of making magnetic measurements on a moving ship, and the brig *Galilee,* chartered at San Francisco and refitted for this special purpose, is now engaged on such a survey in the North Pacific Ocean. Considering that the oceanic areas are in the aggregate about three times the aggregate of the continental areas, it is seen that the fulfillment of the plan contemplated will add greatly to our knowledge of the actual distribution of terrestrial magnetism, even if it should not immediately elucidate this obscure phenomenon.

Minor Projects.

Separate mention of the large number of investigations carried on by the aid of small grants would require undue space here. It will be seen from the list given above that there were sixty-four such grants subject to payment during the year. Many more than this number of investigations, however, were under way, while a few grantees of the year have been unable to begin their projects. A number of researches undertaken by aid of grants made in previous years have been completed and offered for publication. Some of these have been issued during the year and several of them are now in press. It should be stated also that numerous preliminary papers resulting from researches under way have appeared in the current journals. A list of these, obtained by aid of the authors themselves, will be found on pages 43–50 of the 'Year Book.'

Specially worthy of mention among the minor projects are the following, by reason of contributions already published or soon to be ready for publication, namely:

1. The archeological and geological researches of Professor Raphael Pumpelly in Turkestan. The first volume of a report on these researches has been issued during the year and a second is in preparation. Professor Pumpelly had planned to resume field work in Turkestan during the past summer, but the Russian government declined to permit him to return there at this time.

2. The preparation by Professor Lewis Boss of a fundamental catalogue giving the precise positions of about six thousand stars, embracing all stars from the brightest down to the sixth magnitude. This will make a solid contribution to stellar astronomy.

3. The researches on the moon by Professor Simon Newcomb.

4. The precise quantitative investigations of Professor A. A. Noyes and T. W. Richards in chemistry.

5. The comprehensive researches in geology and cosmology by Professor T. C. Chamberlin, whose preliminary papers have already proved full of interest and suggestion to a wide circle of readers.

6. The work of Professor Carl Barus on the nucleation of dust-free atmosphere; of Professor E. W. Scripture on researches in phonetics; of Professor G. R. Wieland on American cycads, and the work of Mr. W. L. Tower on the evolution of beetles, all of which are now in press.

Publications and Their Distribution.

One of the most pressing demands that fell to the president immediately after assuming the duties of his office was that of devising a mode of distribution of the publications of the institution. Accordingly, at the meeting of the executive committee held January 9, 1905, the following tentative rules were submitted and adopted:

1. That, unless otherwise ordered by the executive committee, the edition of the publications of the Carnegie Institution of Washington be 1,000.

2. That, unless otherwise ordered by the executive committee, the publications be distributed as follows: (*a*) to the founder and trustees of the institution; (*b*) to the leading public libraries of the world; (*c*) to a few of the principal journals which give space to critical reviews of current scientific progress.

3. That, subject to approval by the president, authors of publications of the institution be permitted to designate a list of 100 persons to whom copies of said publications may be sent free of charge.

4. That authors be furnished free of charge with 25 copies of their contributions published by the institution.

5. That the president have authority to distribute not to exceed 100 copies of each publication of the institution, if in his discretion it may seem advantageous to do so.

6. That copies of publications not otherwise provided for be offered for sale at a price sufficient to cover the cost of presswork, paper and binding, plus an addition of 10 per cent.

Soon after the adoption of this basis for action, a list of the principal libraries and institutions of the world contemplated under rule 2 was compiled, and having been approved by the executive committee the work of distribution rapidly followed.

The plan thus adopted has worked without serious embarrassment up to date, but it promises to become inadequate to meet the demands for gratuitous distribution to the less important libraries and to the great number of individuals who may be designated as bibliophiles rather than as users of books. Concerning this matter, some suggestions will be found in a later section of this report.

Great pains have been taken to secure a high quality of paper and first-class presswork for the publications of the institution. This has proved no easy task, since it has been essential to deal with many authors and firms whose desires, standards and

judgments are often found in conflict with what appears to be for the best interest of the work from the institution's point of view. Thus some lack of obviously desirable uniformity in paper, presswork and binding has resulted. Certain of these defects have been unavoidable, owing to the fact that some publications had been intrusted wholly to grantees or authors. It is hoped, however, that arrangements will soon be perfected whereby the desired uniformity and excellence in paper and presswork of the publications of the institution may be secured.

A list of the twenty volumes published by the institution during the year will be found on page 42 of the 'Year Book.' They aggregate 2,339 octavo pages and 1,450 quarto pages, making a total of 3,789 pages.

SUGGESTIONS CONCERNING PENDING PROBLEMS OF THE INSTITUTION.

Large Versus Small Projects.

Rationally considered, the development of a novel institution, like the Carnegie Institution of Washington, can not be expected to proceed without encountering difficulties and dangers. That the mere establishment of such an institution is no easy matter is witnessed by the fact that the Congress of the United States debated the question of founding the Smithsonian Institution for a decade before attaining a definite plan of procedure. Although the Carnegie Institution of Washington has been free in large measure from difficulties in the way of initial organization, it has nevertheless met with other difficulties of a somewhat ominous character. Among these is that of the relative merits of large and small projects and hence large and small grants.

In the absence of experience it might well appear doubtful whether the income of the institution may be best used in promoting a small number of large projects not likely to be undertaken by other agencies, or whether the income may be best used in promoting a large number of small projects for which the ways and means are already in part available. Strong *a priori* arguments may be adduced in support of each of these extreme methods of administration of the income, and the executive committee has no doubt acted wisely in taking a mean course, testing thus simultaneously, by actual experience, the merits of both methods.

While careful observation and study of these methods during one year only may not justify the recommendation of any radical departure from the course hitherto followed, it seems essential to indicate certain grave objections to the policy of awarding numerous small grants. These objections are:

1. The excessive amount of time and energy required in the consideration of applications for and in the administration of small grants. Thus far the institution has formally considered about 1,200 applications for such grants and has made awards to about 300 applicants; but the amount of attention given to the consideration of formal applications represents only a part of the time and labor consumed by the importunities incident to, if not inherent in the policy in question. Many of the evils of the 'spoils system' already confront us. Some applicants file claims; many are impatient for speedy action; and may, as in the case of academic degrees, speak in the possessive case with respect to grants long before they are awarded.

2. The returns from small grants do not seem to justify the outlay, especially since it is applied in many cases to work which would go on as well without aid from the institution. Probably a more deliberate and searching investigation of the applicant than has hitherto been practicable would insure better results. It is certain, at any

rate, that the possession of a laboratory and enthusiasm, along with a bundle of recommendations, should not suffice to qualify an applicant for the arduous work of research.

3. A graver objection to this system of small grants lies in its tendency to supplant other sources of support for scientific investigation in allied institutions, and especially in colleges and universities. The facts should be known that thus far the institution has carried on work through aid given to about 270 individuals connected with 89 different institutions. Of these latter, nearly three fourths are schools, colleges and universities. Since the normal condition of an educational institution too often borders on poverty, it is only natural that investigators connected with such organizations should look to the Carnegie Institution of Washington for relief. An easy calculation, however, shows that the possible relief from this source in inadequate. Thus, a conservative estimate of the men and women connected with American institutions of learning alone, and capable of making fruitful researches, would include not less than one thousond. The smallest average annual grant that would be effective in such work is $1,000. Hence it is seen that twice the income of the institution would not begin to meet the demands on it coming from educational institutions alone. Depending unduly on another institution for support tends also, it would appear, not only to dry up the local springs of support, but to sap the independence of educational institutions. That any of them should desire to know how much aid may be expected from the institution before making up their budgets for an academic year is a matter of serious import. Obviously it is the duty of the Carnegie Institution of Washington to avoid the danger of supplánting, while seeking in part to supplement, the functions of educational institutions.

No similar difficulties or objections have arisen in the administration of the larger projects of the institution. In the case of these projects, however, the ways and means are provided by rather than for, and the investigators are chosen by rather than for, the institution. In short, the institution is, in this case, enabled to assume and fix responsibility in the conduct of its affairs and to push them energetically; whereas, in the other case, responsibility is divided, energy is generally lacking, and time and money are in constant danger of being frittered away amongst a multitude of minor interests.

Summarily stated, therefore, the indications are that the policy of awarding numerous small grants to self-suggested investigators is destined to break down under the sheer weight of the importunities it entails; that the results to be expected from such grants are meager; and that the award of them, unless narrowly limited and carefully guarded, may work grave injury to educational institutions.

New Projects.

The demands for attention from applicants for small grants have left scant time during the year for the consideration of more important prospective work falling within the scope of the institution. It has been deemed essential, also, to devote most of this time to the larger projects already under way, with a view to increasing their facilities and insuring their success. Nevertheless, many new projects have been contemplated, and several of these may be formulated for action without undue delay whenever the institution is ready to consider them.

Two of these projects which merit special attention, by reason of the fact that they have been considered at much length by advisory committees and by the executive committee during the past three years, are: (1)

an astronomical observatory in the southern hemisphere and (2) a laboratory for geophysical research. . Referring to 'Year Books' 1 and 2, therefore, for voluminous details with reference to the history of these projects, it is desired here to commend them as worthy of favorable action by the board of trustees as soon as the essential funds are available.

With regard to new projects in general it appears fitting here to call attention to the desirability of allotting ample time for the preparation of plans and specifications and to the necessity of allotting ample time for their execution. The inevitable dangers that confront a research institution are dilettanteism and haste for results. Thorough deliberation in preparation and energetic patience in execution are indispensable to the highest success of such projects.

Since the query whether different departments of research are likely to be equally promoted by the institution is often raised, it seems worth while to remark that it is an obvious duty of the executive committee to select those projects which give highest expectations of adequate returns. Projects of this kind are generally susceptible of denite specifications as to ways, means and objects. At present, however, judging from the great inequalities in definiteness of the projects submitted to the institution, it must be much easier to formulate plans for good work in some sciences than in others. Hence, quite irrespective of personal prepossessions, it seems best, in this case, to follow lines of least resistance, promoting chiefly those departments of research which promise sure returns, while seeking at all times to raise the less highly developed to the level of the more highly developed sciences.

Suggestions on Distribution of Publications.

A difficulty which is likely to beset the institution in the near future is that of a just and equitable distribution of its publications. Society has only lately emerged from a period when libraries were maintained chiefly for librarians and bookbinders and when every scholar was either his own librarian or a bibliophile. Along with this *laissez faire* system there grew up also a system of exchanges, especially between learned academies and men of learning; but the number of such academies and individuals was until lately quite small and well within the limits of a possible free distribution or exchange of publications. In recent decades, however, the number of institutions maintaining libraries and the number of individuals desiring access to publications have greatly increased. The needs of individuals, it must be said, have been admirably met in a general way by the facilities afforded in all of the great libraries of the world, so that the worker with books can no longer afford to be his own librarian any more than he can afford to be his own banker. Nevertheless, the demand for a free distribution of books has increased to an extent far surpassing the increase in effective libraries and effective workers with books. This demand has grown to large proportions in the United States especially, partly by reason of the broadcast distribution of public documents.

Questioning the wisdom of an indiscriminate distribution of the publications of the institution, the provisional rules given on page 128 above were drawn along conservative lines. The experience of the year, however, shows that great pressure will soon be brought to bear on the institution by individuals and by smaller libraries desiring to be placed on the free omnia list. Since drawing up such a list, which embraces about three hundred of the leading libraries of the world, an attempt has been made to prepare various special lists of institutions and individuals to

which, respectively, publications in the varied departments concerned might be sent. This attempt has developed certain baffling obstacles. Chief among these is the awkward duty of discriminating between the persons and the institutions which should and those which should not receive books gratis. The officer called upon to decide must necessarily play the rôle frequently of a dispenser of favors, and be thus subject to the charge of favoritism.

The practical questions raised by this matter are, first, Is the work entailed worth what it costs? And, secondly, Does such work advance science? My opinion is that both questions should be answered in the negative; and my suggestion is that a distribution of publications at once practicable, equitable and effective may be attained by offering all of them for sale except those reserved for free assignment to authors and to the leading libraries of the world. Publications thus distributed would be pretty certain to go where they are needed, and they would thus also stand or fall by reason of their merits or demerits, as the case may be.

Relations of Institution to the Public.

Precisely what relations the Carnegie Institution of Washington should sustain to the public is a question which does not admit a ready answer. Experience alone can disclose a complete reply, since it must evolve with the development of the institution itself. Clearly, however, it must be regarded as a semi-public organization, somewhat similar to a university. More exactly, it may be likened to a university in which there are no students.

Obviously the institution ought to sustain close relations with universities, since they are now the chief centers of research; and, within the limits permitted by mutual independence, those relations should be cooperative, to the end that time and effort may be conserved. Similar relations should obtain, likewise, between the institution and learned societies. But the possible methods of effective cooperation remain, essentially, to be discovered.

Much less obvious, though hardly less essential of provisional definition, are the relations which the institution should sustain to the larger, non-academic world. One of the favorable signs of the times is seen in the intelligent interest taken in the affairs of the institution by this larger world. In spite of a widely prevalent tendency to anticipate the marvelous and the spectacular from scientific investigations, and thus to expect too much, if not the impossible, there is manifest a very generally just appreciation of such work. Hence the commendable eagerness of the modern public to learn the results of recondite researches calls for some sort of cooperation between the institution and existing media for the dissemination of information, with a view to furnishing such information in a form at once intelligible and trustworthy. This, among many other questions concerning the relations of the institution to the general public, seems to merit special consideration in the near future.

Attention may be not inappropriately called here to the fact that while the institution deeply appreciates the interest in its affairs shown by the public, there is no possibility of following more than a small fraction of the suggestion and the advice welcomed from that source, for their abundance is overwhelming and a choice must be made. Out of the chaos of such suggestion and advice and out of the deliberations within the institution itself, ways and means for growth and achievement will be found. In the meantime there will be a common need for application of the forbearance and the patience so indispensable

to the higher forms of research which it is the object of the institution to promote.

R. S. WOODWARD.

November 11, 1905.

ANNUAL MEETING OF THE CENTRAL BOTANISTS HELD AT ANN ARBOR, DECEMBER 28 AND 29, 1905.

THE annual meeting of the Central Botanists was held on the afternoons of December 28 and 29 at Ann Arbor, conjointly with morning sessions of the Society for Plant Morphology and Physiology on the same days. The meeting was opened by past-president Professor Stanley Coulter, and Professor F. C. Newcombe was elected president for the ensuing year and presiding officer for this session. He with the past-president, Professor William Trelease, and Secretary-treasurer Dr. H. C. Cowles will constitute the executive committee for next year.

The following papers were read:

The Structure and Division of the Oospore in Coleochaete: CHARLES E. ALLEN.

Three species were studied—*C. scutata*, *C. soluta* and *C. pulvinata*. The oospore contains a large nucleus and eight parietal chromatophores, each of the latter containing, usually, one pyrenoid and many starch grains. In the cytoplasm are many large rounded vacuoles, which are not fat drops, but which contain varying amounts of a substance which stains blue in the triple stain. The time of germination in the spring depends upon the season, the prophases of the first division appearing (in *C. scutata*) about three weeks after the disappearance of the ice. Divisions were induced in the oospore of *C. soluta* by bringing the plants indoors in the fall and keeping them in changing water at a temperature of about 12°–13° C. The first and second nuclear divisions in the germination of the oospore display the characteristics respectively of the heterotypic and homeotypic mitoses in the higher plants. From these facts it is concluded that chromosome reduction occurs immediately upon the germination of the oospore; there is, therefore, no cell generation, except the oospore itself, which contains the double number of chromosomes, and hence no sporophyte generation.

Spore Formation in Derbesia: BRADLEY M. DAVIS.

The Life History of Polysiphonia: SHIGEO YAMANOUCHI. (Presented by Dr. Davis.)

Variation of Habitat of some Bog Plants in Michigan: CHARLES A. DAVIS.

Spore Formation in the Many-spored Asci in Streptotheca and Rhyparobius: J. B. OVERTON. (Presented by Dr. Allen.)

The Division of the Nuclei in Living Filaments of Oscillatoria: EDGAR W. OLIVE. (Presented by Dr. Allen.)

Living filaments of *Oscillatoria* show, under dim illumination, two sharply differentiated regions—lens-shaped, refractive, granular bodies, alternating with clear, vacuole-like spaces. The latter are the so-called 'central bodies.' These on examination are seen to be in a state of division, and their constriction is accomplished by the growth inward from the periphery of a ring-formed partition. Every few cells apart in a filament will be seen regions of maximum division, where constriction has progressed farthest, and regions of minimum division. Thus maxima and minima alternate rhythmically with one another. The 'central bodies' prove to be nuclei, on sectioning and properly staining, which are constantly in a state of division, since they never appear to enter on a state of rest.

Cortinarius as a Mycorhiza-producing Fungus: CALVIN H. KAUFFMAN.

It was shown that the red-colored mycelium of an undescribed species of *Cor-*

tinarius formed ectotrophic mycorhiza on at least three forest plants, viz., *Acer saccharinum* Wang., *Quercus rubra* L. and *Celastrus scandens* L. In two cases the fruit-bodies were found, attached to the strands which were associated with the roots. Other trees and shrubs in the same locality, even including individuals of red oak, had no connection with the fungus.

Further Studies on the Ascus: J. Horace Faull.

The differences of opinion regarding the systematic position of the Laboulbeniaceæ have been in a large measure due to ignorance of the nuclear phenomena within the spore sac. An examination of a fair abundance of material shows that the young spore sac is occupied by a fusion nucleus, that three generations of nuclei follow, that as a rule four of the last generation pass to the upper end of the spore sac and break down, and that through the activity of the rest four spores are formed. These spores are formed in a way that differs in no essential respect from that already described for several of the Ascomycetes. The paper concluded with a summary of the essential phenomena of *Ascus* and spore formation in Ascomycetes, and with these the phenomena just noted in *Laboulbenia* were found to agree.

Ecological Reconnaissance of the Isle Royal Region: W. P. Hilt.

Notes on Nebraska Grasses: Charles E. Bessey.

Bradley M. Davis,
Secretary pro tem.

SCIENTIFIC BOOKS.

A Text-book of Physiology. For medical students and physicians. By William H. Howell, Ph.D., Professor of Physiology in the Johns Hopkins University. Philadelphia, W. B. Saunders and Co. 1905. Pp. 905. 8vo. Cloth, $4.00.

The 'American Text-book of Physiology,' which had its first edition in 1896 under the editorship of Professor Howell, was at that time and is perhaps now the most pretentious effort of American authors in physiology. It was thought that 'the advantages derived from the collaboration method' would be great in that it would give the reader the advantage of the specialist's point of view in every field of physiology. As a matter of trial these joint author text-books are proving heavy for the student and are being relegated to the field of the reference book. Users of the 'American Text-book,' who are, therefore, familiar with the uniform high excellence of the chapters written by its editor, will be more than gratified by the appearance of the present volume by Professor Howell. The author's well-known terseness of style and directness of statement permeate the book from cover to cover. The treatment is kept well within the limits set by the title-page, yet Dr. Howell has gone far afield into the most recent literature, giving us a storehouse of physiological fact and scientific theory such as one rarely finds in a modern text-book.

Much new material, evidently the accumulated experiences of the Johns Hopkins laboratories, is presented to the public for the first time. The number of new illustrations is a feature of the work. Of the two hundred and seventy-two illustrations about one half are original.

The author has departed radically from the conventional arrangement of subject matter by introducing as the second and third sections, respectively, the subjects of 'The Central Nervous System,' and 'The Special Senses.' Professor Howell has always, both as a teacher and a writer, emphasized the necessity for laboratory experience by the elementary student as a necessary preparation for the presentation of the principles of physiology. The subject of muscle and nerve, treated in the first section of the volume, of all the subdivisions of physiology, unquestionably lends itself best to experimental demonstration to the student. The facts can be more directly observed with less confusion by indeterminate factors, and the subject matter can be used to give a more rigid training in experimental technique. These three chapters, *i. e.*, on

'Muscle and Nerve,' 'Central Nervous System' and the 'Special Senses,' prepare the way for the presentation of the complex nervous coordinating machinery found in the digestive, the respiratory or the circulatory systems, for example. The statement of the details of the sensory apparatus and the afferent nervous system thus early in the text seems strictly logical from this point of view, and it is gratifying to see an author of eminence take the responsibility for the order of presentation.

The relative space allotted to the various sections is good, and the subdivision of sections into chapters and paragraphs presents an analysis that appeals to the reader as both logical and exhaustive. This analysis, together with the printing of the paragraph topics in bold-face type, lends itself to quick and satisfactory use as a reference, a feature particularly valuable to the advanced medical student and the physician.

The general sections presented are as follows: 'The Physiology of Muscle and Nerve,' 105 pages; 'The Central Nervous System,' 127 pages; 'The Special Senses,' 132 pages; 'The Blood and Lymph,' 53 pages; 'The Organs of Circulation of the Blood and Lymph,' 132 pages; 'Respiration,' 68 pages; 'Digestion and Secretion,' 149 pages; 'Nutrition and Heat Production and Regulation,' 56 pages; 'Reproduction,' 35 pages; and an Appendix of 13 pages.

The section on 'The Physiology of the Organs of the Circulation of the Blood and Lymph,' 132 pages, has the following nine chapters, each with from 7 to 15 sectional topics: the Velocity and Pressure of the Blood Flow, 26 pages; the Physical Factors Concerned in the Production of Blood-pressure, 9 pages; The Pulse, 8 pages; The Heart Beat, 19 pages; The Cause and Sequence of the Heart Beat—Properties of Heart Muscle, 16 pages; The Cardiac Nerves and their Physiological Activity, 19 pages; and The Vasomotor Supply of the Different Organs, 16 pages.

The detail with which each chapter is treated is well illustrated by the subtopics on the twenty-five pages devoted to the chapter on 'The Cardiac Nerves and their Physiological Action.' These topics are: Course of the Cardiac Nerves, Action of Inhibitory Fibers, Analysis of Inhibitory Action, Effect of the Vagus on the Auricle and the Ventricle, Escape from Inhibition, Reflex Inhibition of the Heart Beat, the Cardio-inhibitory Center, the Action of Drugs on the Inhibitory Apparatus, the Nature of Inhibition, Course of the Accelerator Fibers, Tonicity of the Accelerators and Reflex Acceleration, the Accelerator Center.

A notable chapter, not often found in such text-books, is introduced at the end of the section on the 'Central Nervous System' on the neglected subject of sleep. The sectional topics of this chapter are: Introductory Statement, Physiological Relations during Sleep, The Intensity of Sleep, The Effect of Sensory Stimulation, Theories of Sleep, Hypnotic Sleep.

The type and press work, and especially the illustrations, are good. The publishers have maintained their recognized high standard of mechanical excellence. By a choice of thin paper the size of the volume is kept within reasonable limits. However, it is to be regretted that a book which will unquestionably rank as the leading text-book of physiology issued in America could not be printed on light-weight linen paper.

CHARLES W. GREENE.
UNIVERSITY OF MISSOURI,
COLUMBIA, MO.

Karl Heumann's Anleitung zum Experimentieren bei Vorlesungen über anorganischen Chemie. Von Professor Dr. O. KÜHLING. Dritte Auflage. Braunschweig, Friedrich Vieweg und Sohn. 1904. Pp. xxix + 818. Price, gbd. 20 Marks.

The first edition of this admirable work appeared in 1876. Since then great advances have been made in the subject of inorganic chemistry and many of the new discoveries have found an appropriate presentation in the lecture room. Space has been found for the presentation of this new material, partly by the omission of parallel experiments previously given in several forms, and by the omission of methods of preparing substances which are

now easily obtained, partly by the addition of one hundred and fifty pages to the book. The larger part of the new experiments pertain to electrochemistry, but there have been included, also, experiments with liquid air, Goldschmidt's process for obtaining high temperatures and a considerable number of experiments to illustrate the principles of the newer physical chemistry. One finds, also, experiments with hydroxylamine, hyrazine, hydrazoic acid and with fluorine. The new experiments as well as the old are, in general, well selected and clearly described. Only occasionally is an error to be noted, as where the decomposition of ammonia gas by electric sparks is spoken of as an electrolysis. Every one who has occasion to give experimentally illustrated lectures in chemistry will find in the book a storehouse of valuable material. W. A. N.

A Treatise on Chemistry. By Sir H. E. Roscoe and C. Schorlemmer. Vol. I., The Non-metallic Elements. New edition completely revised by Sir H. E. Roscoe assisted by Drs. H. G. Coleman and A. Harden. London, Macmillan & Co., Ltd.; New York, The Macmillan Co. Pp. xii + 931.

This book has been so well and so favorably known since its first appearance more than twenty-five years ago that an extended notice is not necessary. Those features which made the first edition such delightful reading have been retained, while, at the same time, the authors have incorporated with painstaking care the results of a very large amount of experimental work which has enriched our science during the past quarter of a century. The completeness and accuracy with which this has been done are really surprising.

A rather brief discussion of the properties of solutions from the modern point of view is given, but in matter pertaining to the newer physical chemistry the book can not be considered as altogether satisfactory. The omission of the chapter on crystallography is to be regretted. It also seems unfortunate that the double standard for atomic weights should be used at a time when chemists seem to have decided pretty generally in favor of a single standard.

A very good though rather brief account of the gases of the helium group is given.

W. A. N.

Cours de Chimie. A L'Usage des Etudiants du P. G. N. Par R. de Forchand. Paris, Gautier-Villars. 1905. Vol. I., 325 pp.; Vol. II., 317 pp. Price, 10 francs.

These books, according to the author's statement, are intended for the use of students who are intermediate in attainment between those who are candidates for the bachelor's degree and for the degree of master of arts. They are intended to furnish the basis for three exercises a week for one year. The plan followed is that of presenting an outline of the more important theories of chemistry first before considering any details with regard to the elements or their compounds—a method which may answer for students who have already acquired a considerable knowledge of the subject, but one which is wholly unsuitable for beginners. The theoretical point of view of the book corresponds more nearly to that of the average chemist fifteen years ago than to the present condition of the science. One is surprised to find the long-abandoned 'principle of maximum work' presented as one of the fundamental principles of chemistry; also the old formula Cl-O-O-OH for chloric acid. The portions devoted to organic and to analytical chemistry are so brief as to be quite unsatisfactory. In the former many structural formulæ are given, but no attempt is made to give the student an idea of the means by which such formulæ are developed.

By an oversight the author has retained the old value for the density of hydrogen. Less excusable is the value 15.84 for the atomic weight of oxygen on the hydrogen basis, calculated from the value 1.01 for hydrogen, as given by the international committee, and that too with the statement that the ratio is very accurately known.

The volumes contain no index.

W. A. N.

STRABO ON CLIMATOLOGY.

Klimalehre der alten Griechen nach den Geographica Strabos. Von Dr. Hans Rid. Kaiserlautern, 1904. 8vo. Pp. 62.

Strabo has been called the greatest geographer of ancient times. His views on geographical subjects were remarkably advanced, and his statements on the particular division of geography which has now become known as climatology were in most cases surprisingly accurate. In the little volume before us, Dr. Rid gives an excellent presentation of Strabo's views on climatological matters. While adopting the division of the earth's surface into five zones, which Parmenides had probably originally proposed, Strabo recognized the fact that the 'torrid' zone, which was then believed to be uninhabitable because of the heat, was at least partly habitable. He was also the first of the Greeks to state explicitly the fact that mountain climates have lower temperatures than the surrounding lowlands. He realized that what we now call *solar* climate is much modified by the physical features of the earth's surface, and that a latitude line runs through diverse climates. This was a distinct step in advance. Some of the relations of climate and man were emphasized by Strabo in much the same words as those we use to-day. The discussion by Dr. Rid will prove interesting to classical students as well as to climatologists.

R. DEC. WARD.

SCIENTIFIC JOURNALS AND ARTICLES.

THE October-November number of *The Journal of Geology* gives a biographic sketch of Ferdinand, Freiherr von Richthofen, by Mr. Bailey Willis. This is followed by the leading article, entitled 'Structure and Relationships of American Labyrinthodontidæ,' by E. B. Branson. He describes a new genus and under it two new species. The article is accompanied by fourteen figures. Professor John J. Stevenson's 'Recent Geology of Spitzbergen' deals mostly with glaciation and the submerged channels of the island. Professor Stuart Weller, in his article on 'The Northern and Southern Kinderhook Faunas,' says: "The interrelationships of the various expressions of the Louisiana-Kinderhook-Burlington faunas under discussion are such as to make their correlation a matter of some certainty." The last article of the number is an illustrated one on 'The Development of Scaphites,' by W. D. Smith. The writer concludes that 'the genus *Scaphites* is in need of revision' since it is polyphyletic.

THE fore-part of the October number of *The American Geologist* is devoted to 'Ten Years' Progress in the Mammalian Paleontology of North America,' by Professor Henry Fairfield Osborn. He traces the lines along which research has been conducted and points out the directions in which future results may be expected. Dr. Osborn's article is illustrated by seven diagrammatic figures. 'Some Geological Observations on the Central Part of the Rosebud Indian Reservation,' by Mr. Albert B. Reagan, gives some interesting sections of Tertiary and Cretaceous formations and also an account of the surface features with a geological map of the reservation. Dr. August F. Foerste's 'Notes on the Distribution of Brachiopoda in the Arnheim and Waynesville Beds' give some valuable information regarding species found associated in these beds. In the editorial comment on 'The Willamette Meteorite' Professor Winchell takes exception to Dr. Ward's atmospheric pressure theory of the formation of the concavities in its base and regards them as the spaces formerly occupied by some such minerals as olivine and troilite which have been removed since its fall by the ordinary processes of rock decay.

SOCIETIES AND ACADEMIES.

THE OHIO ACADEMY OF SCIENCE.

THE fifteenth annual meeting of the academy was held in Cincinnati on November 30, December 1 and 2, 1905, the president of the society, Professor Herbert Osborn, presiding. On Thursday evening an informal meeting took place at the Museum of the Society of Natural History. The sessions on Friday and Saturday were held in Cunningham Hall, at the University of Cincinnati.

The address of the president of the society, on 'The Origin of the Wings of Insects,' occurred at 1:15 P.M., on Friday, and at 7:30 P.M. President Dabney of the University of Cincinnati, vice-president of the society, de-

livered an address entitled 'Our Modern Universities.' Other important papers were those by Professor C. J. Herrick, 'On the Present Status of Comparative Psychology, Professor M. F. Guyer, on 'Guinea-chicken Hybrids' and Mr. A. F. Burgess, on 'A Preliminary Report on the Mosquitoes of Ohio.'

The following program was presented:

Robert F. Griggs: 'Report on the Willows of Ohio.'

J. H. Todd: 'The Relation of Medicine to Anthropology.'

Henry F. Kock: 'Observations on *Euglena viridis* and *Euglena sanguinea*.'

E. W. Berger: 'Habits of the Pseudoscorpionidæ (principally *Chelanops oblongus* Say).'

H. P. Fischbach: 'Some Notes on a Myxobolus Occurring in a Diseased Fish (*Abramis chrysoleucas*).'

F. J. Hillig: 'A New Case of Mutation (*Commelina nudiflora*).'

F. Carney: 'The Geology of Perry Township, Licking Co.,' illustrated by lantern slides.

Charles Dury: 'How to Collect and Breed Xenos.'

L. B. Walton: 'A New Species of Japyx (*J. macgillvrayi*) with some Notes on the Morphology of the Hexapoda and Chilopoda.'

J. S. Hine: 'Notes on some Ohio Mammals.'

W. A. Kellerman: 'Corn Rust Cultures.'

W. F. Mercer: 'The Relation of the Motor Nerve-Endings to the Voluntary Muscle in Amphibia.'

J. H. Schaffner: 'The Reduction of the Chromosomes in Microsporocytes.'

A. D. Cole: 'Optical Experiments with Electric Radiation.'

M. F. Guyer: 'Guinea-chicken Hybrids.'

L. G. Westgate: 'Glacial Erosion in the Finger Lakes Region, New York.'

L. B. Walton: 'The Naididæ of Cedar Point, Ohio.'

Harris Handcock: 'The Present State in the Development of the Elliptic Functions.'

W. C. Mills: 'Mammilla of the Baum Village Site.'

W. R. Lazenby: 'Foreign Trees Naturalized in Ohio.'

E. W. Berger: 'Notes on the Fall Webworm (*Hyphantria cunea*) in Ohio.'

J. S. Hine: 'Life-history Notes on Three Species of Mosquitoes.'

A. M. Miller: 'Recent Classification and Mapping of Lower Ordovician in Kentucky.' Illustrated by lantern slides.

S. R. Williams: 'The Anatomy of *Boophilus annulatus* Say.'

C. J. Herrick: 'On the Present Status of Comparative Psychology.'

W. A. Kellerman: 'A Botanical Trip Through Gautemala.' Illustrated with lantern slides.

Herbert Osborn: 'Further Report on the Hemiptera of Ohio.'

J. M. VanHook: '*Ascochyta pisi*, a Fungus of Seed Peas.'

Lynds Jones: 'Additions to the Birds of Ohio.'

W. A. Kellerman: 'Exhibition of Selected Gautemalan Plants.'

J. H. Todd: 'The Garden of the Titans—Its Geology.'

Chas. Brookover: 'The Prosencephalon of *Amia calva*.'

E. L. Moseley: 'The Cause of Trembles in Cattle, Sheep and Horses, and of Milk-sickness in Man.'

G. D. Hubbard: 'Physiography and Geography.'

W. C. Mills: 'Description of a Teepe Site, Baum Village Site.'

C. E. Ballard: 'A New Gregarine from the Grasshopper (*Melanoplus atlanis*).'

W. R. Lazenby: 'Habits of Introduced Weeds.'

G. B. Halsted: 'An Application of Non-Euclidean Geometry.'

W. F. Mercer: 'Development of the Respiratory System in Amphibians.'

Gerald Fowke: 'Superficial Geology between St. Louis and Cairo.'

W. C. Mills: 'Human Jaws as Ornaments.'

L. B. Walton: 'Some Laboratory Methods.'

W. R. Lazenby: 'Notes on the Germination of Seeds.'

F. Carney: 'Glacial Studies in the Vicinity of Newark.'

A. F. Burgess: 'A Preliminary Report on the Mosquitoes of Ohio.'

W. A. Kellerman, H. H. York and H. A. Gleason: 'Annual Report on the State Herbarium.'

Lynds Jones: 'A Contribution to the Life History of the Common Tern (*Sterna hirundo*).'

F. O. Grover: 'Notes on some Ohio Spermatophytes.'

W. B. Hermes: 'Studies on Insects that Act as Scavengers of the Organic Beach Debris.'

Albert Wetzstein: 'A List of the Plants of Auglaize Co., O.'

R. E. Brockett: 'Some Plants on the Campus and in the Vicinity of Rio Grande College.'

Lumina C. Riddle: 'Bembicidæ of Ohio and

Notes on Life History of *Microbembex monodonta* Say, and *Bembex texana* Cress.'

C. F. JACKSON: 'A Key to the Families and Genera of Thysanura with a Preliminary List of Ohio Species.'

JAS. A. NELSON: 'A Note on the Occurrence of Sex Organs in Æolosoma.'

J. LINDAHL: 'Barite in a New Form (Pisolitic) from a 1,400 Foot Boring for Oil at Saratoga, Texas.'

VICTOR STERKI: 'Preliminary List of Land and Fresh Water Mollusca of Ohio.'

VICTOR STERKI: 'A Suggestion with Respect to Local Fauna Lists.'

VICTOR STERKI: 'Some General Notes on the Land and Fresh-water Mollusca.'

Several important resolutions were adopted. Among those of local interest was that relating to a proposed natural history survey of the state, a committee consisting of the retiring president, and the president and secretary elect, being appointed for the purpose of bringing the matter before the general assembly. A committee was also appointed for the purpose of securing the cooperation of the libraries in the state to the end that scientific papers be rendered more available for members of the society.

A resolution urging the necessity for a biological survey of the Panama Canal Zone before the cutting of the canal was unanimously adopted and the secretary was instructed to transmit the resolution to the proper authorities at Washington.

After resolutions were passed expressing the appreciation of the society for the courtesies extended by the people of Cincinnati, the faculty of the University of Cincinnati, and the officers of the Museum of Natural History, and, furthermore, thanking Mr. Emerson McMillin, of New York, for his continued interest in the welfare of the academy, the society adjourned. The following officers were elected.

President—Dr. E. L. Rice, Delaware, Ohio.

Vice-Presidents—Mr. Chas. Dury, of Cincinnati, Ohio, and Professor Lynds Jones, of Oberlin, Ohio.

Secretary—Dr. L. B. Walton, Gambier, Ohio.

Treasurer—Professor J. S. Hine, Columbus, Ohio.

Librarian—Professor W. C. Mills, Columbus, Ohio.

Executive Committee (ex-officio)—Dr. E. L. Rice, Delaware; Dr. L. B. Walton, Gambier; Professor J. S. Hine, Columbus; (elective)—Dr. M. F. Guyer, Cincinnati; Dr. L. G. Westgate, Delaware.

Board of Trustees—Dr. G. B. Halsted (in place of retiring trustee).

L. B. WALTON,
Secretary.

THE INDIANA ACADEMY OF SCIENCE.

THE twenty-first annual meeting of the Indiana Academy of Science was held at Indianapolis, on December 1. Forty men and women, mostly young scientific workers of the state, were elected to membership. Eighty-six scientific papers were presented to the academy which met largely in sections. The papers covered topics in physics, chemistry, geology, astronomy, mathematics, botany and zoology. Among those of more general interest were the following:

PROFESSOR F. B. WADE, Shortridge High School: 'Some Scientific Aspects of Tea-drinking.'

BENJAMIN W. DOUGLAS, Indiana University: 'The Use of Peat as Fuel.'

ROBERT HESSLER, M.D., Logansport: 'The Chronic Ill-health of Darwin, Huxley, Spencer and George Eliot.

PROFESSOR JOHN A. MILLER, Indiana University: 'The Solar Eclipse of 1905' (lantern).

PROFESSOR J. C. ARTHUR, Purdue University: 'Notes on the International Botanical Congress of 1905.'

PROFESSOR C. H. EIGENMANN, Indiana University: 'The Habitat and Life History of the Cuban Blind Fishes' (lantern).

The following resolution was adopted:

Resolved: That it is the sense of this academy that the United States government should immediately undertake a complete biological survey of the Panama Canal zone.

The following officers were elected for the coming year:

President—Robert Hessler, M.D., Logansport.

Vice-President—Professor D. M. Mottier, Indiana University.

Secretary—Professor L. B. McMullen, Shortridge High School, Indianapolis.

Assistant Secretary—Professor J. H. Ransom, Purdue University.

Treasurer—Professor W. A. McBeth, State Normal School, Terre Haute.

Editor—Professor E. G. Martin, Purdue University.

J. H. Ransom,
Assistant Secretary.

SOCIETY OF GEOHYDROLOGISTS, WASHINGTON.

The second regular meeting of the society was held on January 3.

An informal discussion was held as to the desirability of substituting the designation 'Division of Underground Waters' for 'Division of Hydrology' as the name for the section of the United States Geological Survey devoted to the investigation of underground waters. This was followed by the regular program.

Definition of 'artesian.' Discussion by M. L. Fuller, G. B. Richardson, C. E. Siebenthal, C. A. Fisher, W. T. Lee and others.

Supplementary to the paper presented by Mr. Fuller at the preceding meeting summaries were presented of the arguments for the various usages of the term, including: (1) For flowing wells, (2) non-flowing wells in which the water rises and (3) deep drilled wells. The relations of deep wells were analyzed and the established facts bearing on the use of the term enumerated. It was agreed that: (1) The original use of 'artesian' was for flowing wells, (2) that the present usage among scientists is not uniform, the number favoring the restriction of the term to flows varying, in a broad way, inversely with the amount of experience in underground water investigation, (3) the popular usage is likewise exceedingly variable, people in areas of non-flowing wells applying the term to any deep wells, while those in flowing well areas use it for this class of wells only, and (4) no definite meaning can be assigned to the word in a given publication unless a definition is given in the same paper.

Terms to distinguish common wells from wells in which water rises, for flowing and non-flowing hydrostatic wells, for the hydrostatic principle, for the hydrostatic basin, for confined and for unconfined shallow groundwaters were regarded as necessary. It was agreed that the term artesian is too expressive to be dropped, notwithstanding its various usages, and that it is the best word for the hydrostatic principle, for the hydrostatic basin, and for water under pressure. It was not, however, considered desirable to extend such usage, depending as it does upon well-defined properties of liquids, upon definite physical laws, and on fundamental geological conditions to cover the incidental features, like the flows of wells, which are dependent in many cases or mere accidents of topography. The application of 'artesian' to all wells in which the water is under hydrostatic pressure was favored.

Indraft Wells in Southern Georgia: M. L. Fuller.

Two wells sunk in the Vicksburg-Jackson limestone in southern Georgia, and characterized by a continuous indraft of air, have recently been reported by Mr. S. W. McCallie, who investigated the phenomena at the speaker's request. One of the wells, located at Boston, encountered a rapidly moving subterranean stream in the limestone at one hundred and twenty feet, the sound of which was distinctly audible. A strong indraft was noted after the completion of the well, which continued without change until the well was finally connected with a pump. The other well, located in the same general locality, encountered a similar swiftly moving underground stream in the limestone and presented the same strong indraft. Investigation showed that the current was always in the same direction and was independent of barometric pressure and temperature. Mr. McCallie believes that the sucking in of the air is due to the friction of the rapidly moving water on the air, which is drawn in and carried onward until the water rises as one of the large limestone springs of the region. The conditions are almost exactly reproduced artificially in the Richard suction apparatus in use in nearly all chemical laboratories.

M. L. Fuller,
Secretary.

THE AMERICAN CHEMICAL SOCIETY. NEW YORK SECTION.

The third regular meeting of the New York Section, American Chemical Society was held

at the Chemists' Club, 108 West 55th Street, on Friday, December 8. Messrs. Dr. Wm. J. Schieffelin, Dr. F. D. Dodge, Hugo Schweitzer, T. J. Parker and Leo Baekeland were elected councilors and the following papers were read:

The Biological Effects of Radium: GUSTAVE M. MEYER.

A résumé of the results of the investigations carried out at the suggestion of Dr. Gies by Drs. Gager, Burton-Opitz and Meyer and Messrs. Berg, Welker and Hussakoff concerning the effects of radium and radium rays on plants and animals. A preliminary report of the same has already appeared in SCIENCE, Vol. 21, pp. 987–988, June, 1905.

The Estimation of Minute Quantities of Arsenic: H. B. BISHOP.

For the determination of traces of arsenic in sulphuric acid, brimstone, organic matter and most substances soluble in or decomposed by hot concentrated sulphuric acid, the arsenic is separated by distillation with a mixture of sulphurous and hydrochloric acids, and is estimated by a modified Marsh test. By this method arsenic-free sulphuric acid has been prepared and .0000001 per cent. arsenic has been added and accurately estimated. The special advantages are that large samples may be taken, few reagents are required and the arsenic is separated from interfering substances without loss, so that the Marsh test can be made under standard conditions.

A New Apparatus for the Extraction of Tannic Acid: ALLEN ROGERS.

For the analysis of tea, coffee and tannin, the author has obtained very satisfactory results by the use of an extraction apparatus consisting of two flasks so arranged and connected by tubes that the solution may be drawn repeatedly over the material to be extracted, the temperature being regulated by placing the apparatus on a water-bath or other source of heat.

The Synthesis of 6-Brom-quinazolines. M. T. BOGERT and W. F. HAND.

The authors describe the synthesis of 6-brom-quinazolines from 5-brom-2-amino-benzoic acid, 5-brom-2-acetaminobenzoic, 5-brom-2-acetaminobenzonitrile, and from 5-brom-2-acetanthranil. The following quinazolines were prepared, with certain of their derivatives:

6-Brom-4-ketodihydroquinazoline,
6-Brom-2-methyl-4-ketodihydroquinazoline,
6-Brom-2-ethyl-4-ketodihydroquinazoline,
6-Brom-2-n-propyl-4-ketodihydroquinazoline,
6-Brom-2-i-propyl-4-ketodihydroquinazoline,
6-Brom-2-i-butyl-4-ketodihydroquinazoline,
6-Brom-2-i-amyl-4-ketodihydroquinazoline,
6-Brom-2-methyl-3-phenyl-4-ketodihydroquinazoline,
6-Brom-2-3-o-tolyl-4-ketodihydroquinazoline.

The Constitution of Quinine: B. L. MURRAY.

A review of our knowledge of the molecular constitution of quinine as ascertained from its chemical reactions, so far as we are able to interpret them to-day. Quinine is so readily decomposed into two different classes of bodies, that its molecule is regarded as consisting of two separate halves; the one a metho-oxy-quinoline, the other a hydrogenated pyridine with side chains at beta and gamma. One side chain is unsaturated, while the gamma side chain is connected both to the nitrogen of its own nucleus, and to the gamma carbon of the quinoline nucleus, thus serving to join the two half molecules. The hydroxyl of quinine is located in this connecting chain, and the methoxy group is found in para-position on the quinoline nucleus.

F. H. POUGH,
Secretary.

THE AMERICAN CHEMICAL SOCIETY.
NORTHEASTERN SECTION.

THE sixty-fourth regular meeting of the section was held Friday evening, December 22, at Simmons College, with President Parsons in the chair. About forty members were present.

Professor James A. Norris addressed the section on 'An Investigation of the Elementary Nature of Tellurium,' in which he discussed the position of tellurium in Mendelejeff's classification, and reviewed the work of various chemists on the atomic weight of that element, and described his own work in preparing pure basic tellurium nitrate, and determining the atomic weight of tellurium by converting that nitrate into tellurium di-

oxide. The tellurium was purified from the members of the other groups of the Mendelejeff's table by precipitating the chloride with sodium thiosulphate, and treating the $Na_2S_4TeO_6$ formed with an alkali. The Te thus obtained was further separated from members of the same group by fractional sublimation of TeO_2. The results obtained for the atomic weight of tellurium agreed very closely with that previously obtained by Brauner, Kothner and others, and the conclusions were drawn that the atomic weight of Te has been accurately determined, that the Te used contains no other element known or unknown, and also that the atomic weight of iodine has been correctly determined. The position of Te in the sixth or eighth group of the table was also discussed.

Arthur M. Comey,
Secretary.

DISCUSSION AND CORRESPONDENCE.

HEREDITY AND SUBSPECIES.

I have read with deep interest, and some surprise, two recent articles in this journal by President David Starr Jordan, entitled, respectively, 'The Loch Leven Trout'[1] and 'Ontogenetic Species and Other Species.'[2] To take them up in sequence, the facts presented in the first article are, in substance, that a trout found in Loch Leven differs from the trout of neighboring lakes and streams in its 'large size, more silvery color, sparcity of spots, the red spots and ocelli characteristic of the brook trout * * * being usually wanting,' while 'the orange edge of the adipose fin, characteristic of the brook trout, is wanting in the Loch Leven trout.' These differences are so marked that the Loch Leven trout (*Salmo levinensis*) 'has been usually considered as a valid species, distinct from the other trout of Great Britain.' President Jordan cites Dr. Day as stating that the Loch Leven trout changes into the ordinary brook trout of England (*Salmo fario*), 'when planted in streams of Gloucester or Guilford, the colors of the Loch Leven trout being seen on exceptionally well-fed individuals only.' He also quotes Dr. Day as regarding some fifteen or more other commonly recognized species of trout inhabiting the lakes, streams and estuaries of Great Britain and northern Europe as 'all forms of one and the same species'; and adds:

> A member of one of these so-called species would be changed to one of the others if it grew up under the same surroundings. These forms are not subspecies, for that implies a divergence which should be hereditary, however slight. They are, if this view is correct, local variations of one species, * * *.

Elsewhere in the same article, President Jordan states the results of transferring Loch Leven trout to the waters of the Yosemite National Park in California, where in the course of ten years they have come to be 'exact representatives in form and color of the common brook trout as seen in the streams of England.' He further says: 'These Loch Leven trout in the Yosemite are typical *Salmo fario,* or brown trout of England.'

While these facts are of extreme interest, and have an important bearing on the evolution and character of local forms, they merely emphasize and confirm conclusions derived from general considerations, and not based on experimental research; or, as in this case, on the incidental results of fish-culture. They point the way, however, to a field of investigation evidently pregnant with interesting results, to which President Jordan has forcibly called attention in his later article on 'Ontogenetic Species and Other Species.' In this paper, however, he takes a position that seems to me quite new, and directly antagonistic to the views held, I think, by the generality of students of geographical variation in birds and mammals, as regards the nature of species and subspecies. He says, for example:

> It remains, however, to be determined whether these environmental forms—these species and subspecies produced by the direct influence of heat, cold, humidity and aridity—are 'ontogenetic species' * * * or whether they have a real existence outside the lifetime of the individuals actually composing the group or species. We do not know which of the traits induced by direct action of the environment, if any, are

[1] Science, N. S., Vol. XXII., No. 570, pp. 714, 715, December 1, 1905.

[2] *Ibid.*, No. 574, pp. 872, 873, December 29, 1905.

actually hereditary and which are not. If we find that the dusky woodpeckers of Vancouver Island retain this shade when reared in Arizona, then humidity would be a real factor in the formation of species. *If such birds, transferred in the egg to a region, should develop in the fashion of the local race of this region, and not like their own parents, then the duskiness is not a true specific or subspecific character.*[3] The real character of the species would be found in the tendency to develop dark plumage in humid surroundings and pale feathers under other conditions. *In such case humidity would be merely a factor modifying individual development but not connected with the origin of species.*[3]

It is hard to believe, on reading the above paragraph and the adjoining context, that the writer has duly weighed the real conditions of the problem; if such be the case, he must have a concept of species and subspecies different from that of most of those who have been most intimately concerned with their consideration. It is also hard to understand the meaning of the term 'hereditary' as used in the above transcript.

Young mammals in the nursling stage have a pelage different in color and texture from that later acquired; young birds have a characteristic nestling plumage different in color and texture from that of the adults, or from that acquired with the first moult. Every experienced mammalogist and ornithologist knows that the local differentiation in color between the subspecific forms of a given group is often (but not always) much more strongly expressed in the first pelage or plumage of the young than in the adults of the same forms. In view of such facts it seemingly goes without saying that local differentiations are transmitted from parent to young, and are hereditary in the usual sense of that term; doubtless, no one questions their continued transmission from generation to generation so long as the environment remains stable. Probably also few would question that were representatives of a strongly marked local form (in the case of birds, either as eggs or mature birds) to be transplanted to a region markedly different climatically from their natural home, they would gradually lose their original characteristics and become, after a number of generations, more or less modified, in better agreement with the new conditions of life. But it would be apparently rash to expect a very material change in a single generation. There is apparently not the least probability that an egg of a large dusky Vancouver woodpecker taken to Arizona would hatch into a smaller pale form like the race native to Arizona.

The case may be somewhat different with fishes, which have a more lax organization, are lower in vital energy, and are probably much more plastic than birds; yet it would be of interest to know whether the eggs of the Loch Leven trout, when taken to other waters, hatch into trout like those that are native to the waters to which the Loch Leven trout eggs had been transferred. In the waters of the Yosemite it appears to have been eight or ten years after the introduction of the Loch Leven trout before it was discovered that they had become indistinguishable from the English *Salmo fario*. It would further be of interest to know whether, *through actual comparison of specimens,* it has been found that *Salmo levinensis,* in losing its Loch Leven characters in California waters, has not also acquired some slight differences from the true *S. fario;* for the California environment must be greatly different from that of England.

So far as known to me, no similar phenomena have been observed in birds, through their transference from one climatic area to another. During the last twenty-five years it has been a common practise to restock certain localities in southern New England and other parts of the northern tier of states with southern quail, in places where the northern birds had nearly disappeared in consequence of severe winters or other causes. It is even said that pure northern stock is now hard to obtain; and I have heard ornithologists congratulate themselves that they had in their collections a few specimens of the original northern bird, taken before the introduction of quail from the south. It is also commonly believed, by those who are in position to know, that the quail of the northern states are now a mixed race. As, however, the imported birds have been brought from the middle portion of the

[3] Not italicized in the original.

eastern United States, as West Virginia, Missouri and Kansas, it is not probable that they would differ enough from the northern birds to be easily distinguishable from them. The introduction of birds from Florida and the Gulf Coast has not been in favor with sportsmen's clubs, owing to their small size and their probable inability to withstand such a radical change in climatic conditions.

It may be added, as vaguely bearing on this point, that some years ago (in 1889) a prominent New York ornithologist (now deceased) received four skins of quail (two pairs) said to have come from South Dakota, which so greatly differed from the other forms of quail known to him that he looked upon them as a new species, of which he prepared a description for publication under the name *Colinus dakotensis*. As they were small and dark, they were later compared with quail from southern Florida and found to be practically the same, and the supposed new species was suppressed. The conclusion reached was that these peculiar South Dakota quail had been imported from Florida; but whether these birds were part of the original importation or from a later generation was never satisfactorily established, and the case is, therefore, without special significance in this connection. The following, however, has a rather direct bearing upon the matter at issue.

In Cuba there is an indigenous species or subspecies of quail (*Colinus virginianus cubanensis*), nearest to the Florida form (*C. v. floridanus*), but differing from it in a marked degree. According to the late Dr. Gundlach[4] quail were introduced into Cuba about one hundred years ago, from just where is not stated, but most probably from Florida. And there doubtless have been other importations since. In 1892 Mr. Frank M. Chapman, of the American Museum of Natural History (to whom I am indebted for the suggestion of this case), collected specimens of the indigenous form and of a form impossible to distinguish from the Florida bird. These latter were undoubtedly descendants of birds long previously introduced into Cuba from Florida, which for many generations had maintained in a large degree the characters of the Florida bird. There also occur in Cuba quail that are intermediate in characters between the true Cuban form and the Florida form, due possibly to interbreeding, but also possibly to the action of environment upon the introduced Florida stock.

There are, however, good reasons for believing that the eggs of small southern forms of widely dispersed species would not, if taken to northern localities, hatch into large birds like those of the new region to which the eggs were transferred. For not only does the size of the bird, in species of wide latitudinal range, decline southward, but also (very naturally) the size of their eggs; and there is, furthermore, as a rule, a reduction in the number forming the set, as made known by me in 1876,[5] mainly on the basis of information furnished by the late Major Charles Bendire, than whom there is no higher authority on the eggs of North American birds. Thus eggs of the cowbird from New England average 23 x 16 mm., and those from Arizona 19 x 14.7 mm. It is perhaps of interest to note that in the American tropics the number of eggs in a set, in most passerine birds, is two or three, while in temperate North America the number is four or five, five occurring here about as frequently as three in the tropics.

A word now as to 'ontogenetic species,' and 'species' and 'subspecies.' President Jordan apparently has, as already said, a different concept for subspecies from that of those who first gave currency to the term. The names of all groups in biology are of course conventional terms, employed by common consent as a convenient means of arbitrarily designating groups of greater or lesser comprehensiveness, and having definite relations to each other in any taxonomic system. In introducing the trinomial system of nomenclature, in 1886, the A. O. U. committee on nomenclature stated[6] that this system, as a matter of

[4] *Journ. für. Orn.*, XXII. Jahrg., Juli, 1874, pp. 300–303.

[5] 'Geographical Variation in the Number and Size of the Eggs of Birds,' *Bull. Nutt. Orn. Club*, I., 1876, pp. 74, 75.

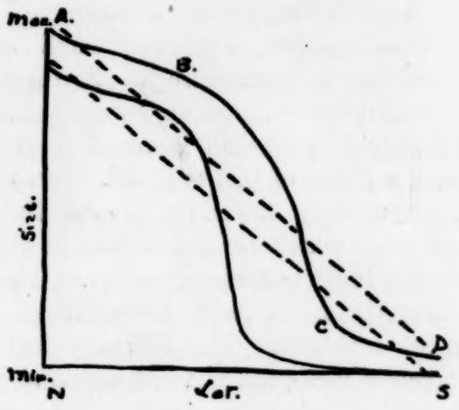
[6] 'A. O. U. Code of Nomenclature and Check-List of North American Birds,' 1886, p. 31.

experience, had been found to be "particularly pertinent and applicable to those geographical 'subspecies,' 'races' or 'varieties,' which have become recognizable as such through their modification according to latitude, longitude, elevation, temperature, humidity and other climatic conditions." This has been till now, and in general still is, the sense in which the term subspecies has been employed and understood by the large number of ornithologists and mammalogists who constantly and systematically make use of it in designating geographic forms that, while well-marked, are known, or supposed, to intergrade. If we are to take President Jordan literally, heat, cold, humidity, aridity or other environmental conditions, are merely factors 'modifying individual development but not connected with the origin of species.' It all depends, it is claimed, upon whether or not the characters shown by the forms commonly designated as subspecies are 'actually hereditary.' If their persistent transmission through practically endless generations be not hereditary, there seems necessary also a new definition for heredity, as well as for subspecies. While the action of all such influences is doubtless ontogenetic, and is by many recognized as such, any attempt to distinguish 'ontogenetic species' from other species, or subspecies, tends to confusion of ideas rather than to any useful discriminations. It may be that President Jordan has failed to clearly express, in the paragraph quoted near the beginning of this article, the ideas he intended to convey, for it seems to me—perhaps through some special obtuseness on my part—that there is lack of coherence, if not actual contradiction, between the parts I have italicized and the portion that intervenes.

J. A. ALLEN.

THE EVOLUTION OF SPECIES THROUGH CLIMATIC CONDITIONS.

THE very interesting paper by Dr. J. A. Allen (SCIENCE, November 24), under the above title, like all really useful discussions of evolution, inevitably suggests further observations. The facts presented are of the highest importance, and for this very reason we want to be quite sure of them in every case. When two 'subspecies' are joined by intermediates, the transition may be uniform all along the line, or it may not. In the diagram here given, the vertical line indicates difference of size; the horizontal one, of latitude; and the 'curves' are plotted in the usual way.



The two more or less parallel lines indicate the extremes of individual variation. Now if 'the variation in size from the north southward is as gradual and continuous as the transition in climatic conditions' (Dr. Allen, *l. c.*, p. 664), the phenomenon will be expressed by the dotted lines, except that in nature the slope will never be quite so uniform, because the change of climate is not perfectly uniform.

If, however (as is surely true of some of the cases Dr. Allen cites), we have two practically uniform subspecies, each true to its own type within a certain area, but having between them a region in which they completely intergrade, the curve will resemble the solid lines of the diagram. The slight slope of the lines from *A* to *B*, and *C* to *D*, will be explicable as the direct result of environment upon individuals. In such a case, it is clear that the two subspecies, in the regions where they remain true, are in fact isolated from one another, and that it is exactly where they are not isolated, that they fail to conform to any single definable type. Such a condition of affairs might very well be produced if two distinct forms had arisen in isolated places, and their ranges had subsequently overlapped, their evolution not having proceeded far

enough for them to be incapable of breeding together.[1]

It will be readily apparent that it is extremely difficult to absolutely demonstrate a case like that represented by the dotted lines. Perhaps in no instance is the series of specimens so complete as could be desired, and usually it is not nearly adequate. The case may be complicated by the existence of half a dozen subspecies, occupying small areas, justifying the nomenclature of the 'aspiring young naturalist.'

Last year I published a revision of *Hymenoxys,* a genus of plants (*Bull. Torrey Bot. Club,* September, 1904). I found in that genus a case which seemed to me to exactly agree with those postulated by Dr. Allen, except that the large form was southern, the small one northern. The difference between the extremes was such as to almost constitute a *reductio ad absurdum* of my classification; yet when I had the whole series (borrowed from several large herbaria) spread out on a table I did not know where to draw any hard-and-fast lines. I accordingly called them all subspecies of *Hymenoxys chrysanthemoides,* but a comparison between plates 22 and 23 of my paper will doubtless cause many readers to wonder how I could do it.

Having myself attempted to demonstrate this case, I perhaps ought not to object to any of Dr. Allen's; but all I wish to urge is, that the evidence should be made more complete and the different classes of cases should be distinguished. In the case of the *Hymenoxys,* we do not know what results would come from sowing Texas seed in the vicinity of the City of Mexico, and *vice versa.* Experiment might show that while the characters of the herbarium specimens overlapped, there were in reality several distinct plants, constitutionally and essentially different, and that even most of the apparent intermediates were really hybrids. Experiment might show, on the other hand, that several so-called subspecies were merely phases of one thing, the individuals directly modified by the climate. This has been demonstrated for certain mountain plants, by dividing a single individual and growing the halves at different altitudes. I do not anticipate these results in the case of *Hymenoxys chrysanthemoides;* but it would be very well worth while to see whether they are attainable.

Finally, it is by no means to be assumed that the 'effects' of climate are necessarily direct, and not brought about through the agency of natural selection. This, however, is a large question, not requiring discussion at this moment.

T. D. A. Cockerell.

[1] *Homo sapiens,* who offers a classical example of segregation without physical barriers, is now being subjected to this very process. The result will probably be greater racial uniformity, or rather the breaking down of racial differences, with increased *individual* variability, due to the fact that while the individuals will cross, many of their *characters* have become so far differentiated that they will not do so. The mongrel dogs in the street afford an illustration of this. How all this will affect the development of the higher human attributes, is a question which deserves serious thought. The increase of insanity and crime in civilized countries, though obviously due largely to quite other factors, may be partly explicable as a result of incongruous combinations, produced by 'Mosaic inheritance.' Genius, if produced in good quantity, may become more erratic. On the other hand, no doubt such evils as war, famine and pestilence will be gradually overcome.

ONTOGENETIC SPECIES AND CONVERGENT GENERA.

The recent exchange of views in Science, between Dr. Jordan and Dr. Allen concerning 'environmental species,' gives occasion to notice the widening gap between the formal conception of species entertained by the biologist as units of evolution, and the actual notion of species used by the systematist in working over a group, or the specialist in arranging a collection. For if 'ontogenetic species' do occur, as there seems reason to believe, a marked distinction must be made in theory between them and the *phylogenetic species,* as they might be termed, denoted by the older, or Darwinian, definition which requires the feature of inheritance of the characters marking them. In practise, of course, this feature has usually been taken for granted

by the systematist, or has rarely been considered at all, for he has no means of testing it, and to him the two sets of adaptive characters must be equally specific, whatever their origin. Nor is it easy to see how a universal measure of discrimination can ever be supplied, for even if a few general laws were derived, as doubtless they will be, from experimental observation of the kind suggested by Dr. Jordan, it is not likely that they would be serviceable in special cases much, if at all, beyond the limits of what we now call local or climatic variation, and, manifestly, it is out of the question that every uncertain case can be brought under such experimental conditions as those which have shown the real relations of the Loch Leven trout. Organic selection has much emphasized this difference between the logical and the practical ideas of species, and has supplied the taxonomist with a problem of which he has no solution in sight. It seems probable that the lack of such a solution is behind the most extreme of the opinions held by the authors of the respective theories of 'mutations' and 'isolation.'

Quite another modifying influence upon present methods of classification appears in the facts of analogous evolution, of which paleontologists have been accumulating evidence. If like environments tend to induce similar modifications in unrelated groups, it at once becomes evident that systems of classification based upon such likenesses of structure may not in all cases reflect the genetic connection which, since Darwin, we have believed them to approach. Therefore, classification in the modern sense being worthless if it fails to correspond to descent, it seems not unlikely that geographical considerations may come to enter more largely into the composition of genera than has hitherto been the case with conservative naturalists, for in a strictly genetic system it would not be permissible to place in the same genus species so widely separated by present or past geographical barriers that we are forced to believe that they can not have developed from the same source.

ARTHUR ERWIN BROWN.
THE ZOOLOGICAL GARDENS,
PHILADELPHIA.

ETHNIC TYPES AND ISOLATION.

RECENTLY several articles have appeared in this journal discussing geographical isolation as a factor in the differentiation of species, and the illustrative observations taken from both the animal and plant life of North America correspond in a way to well-known ethnographical facts. The writer does not intend to discuss the virtues of the isolation theory as a condition of biological variation, but wishes to call attention to the fact that such a theory seems to account for a number of differences in the culture of Indian tribes.

It is customary to divide the aboriginal inhabitants of North America into linguistic stocks and it is estimated that there are at least fifty distinct linguistic families north of Mexico. These were distributed in a very striking way. In the Mackenzie basin we have the Athapascan stock, around the Great Lakes, Hudson Bay and Labrador, down the Ohio River and east to the Atlantic Ocean, the great Algonquin group with an intrusive Iroquois stock in the vicinity of New York state. In the Gulf states were the Caddoan, the Muskhogean, and a number of small groups. The great plains and prairie area was dominated by the Sioux and Shoshone stocks. If in contrast to this we examine the Pacific coast we find in California alone twenty stocks and between the northern boundary and Alaska ten other stocks. The Pueblo region to the south presents conditions somewhat similar. Thus a brief résumé of the distribution of linguistic stocks in North America brings to view relations strikingly similar to the distribution of species as noted by President Jordan.

Some one has proposed to account for the great number of Indian languages in California by assuming that a few young children lost now and then in the isolated valleys of the country would, if they survived, develop new languages. While ethnologists do not take this theory seriously they often give expression to a similar view, viz., that a people without a written language living for a long time in a given area separated from the parent stock will gradually form a new order of speech. This is a theory of differentiation by

isolation. It has often been stated that the geographical character of California was such as to make it, if not the incubator of living stocks, at least their nursery.

However, no satisfactory explanation has been given for the great diversity of languages in North America. The fact that tribes have wandered from Canada to New Mexico and California and after ages of separation still retained their former language indicates a conservatism in linguistic change that renders the isolation theory an unsatisfactory one.

If, however, we do not consider linguistics at all and look at the cultural habits of the people in their more psychological aspects we find more reason for assuming isolation to be an important fact. Notwithstanding the great number of linguistic stocks in California all present cultures that can be distinguished from the cultures of other geographical areas by certain common characteristics. In the plains we find two large powerful stocks with a culture that had other distinctive characteristics in common. Again, in the east were the Iroquois and the Algonquin with the same culture. Plains culture stopped at the woods and woods culture stopped at the grass line; California culture kept to the west of the mountains and the plains culture to the east of them. Thus we have well-defined culture areas corresponding to well-defined geographical areas. In one case high mountains isolated a culture, in the other the woodlands were the cause of separation. The woodlands presented no great physical barriers to the plains people, but the latter had acquired food, shelter and transportation habits that made the woods uncomfortable and a place to be dreaded. A people accustomed to traveling over the free and open plains must have felt uneasy and afraid when traversing the woods, because of inability to see what was just beyond, and the people of the woods must have felt the insecurity of the plains because there were few hiding places and no one could travel without being seen. We all know how the at-home feeling ties us to the tenement or the palatial dwelling, as the case may be. Then, again, a people that had been trained to chase the buffalo on an open plain would not understand hunting in the woods and would be driven back to the plains by the demands of an empty stomach. It is difficult for a race to change its food habits, perhaps much more difficult than for us to change our most pampered ways. Transportation habits will hold a people to the watercourses, the upland, the lowland, etc., as the case may be. Even shelter habits may be binding, as the snow-house building of the Eskimo and the adobe wall-structure of the Pueblo. In general it seems that culture is often confined to a given area because the inhabitants are prevented by physical barriers and cultural habits, such as those of food, shelter, transportation, etc., from affiliation with the culture of other areas. The force of this theory in ethnography is augmented by the fact that the barriers are psychological rather than physical. Yet, as psychological structures they are erected upon physical foundations. It is the character of the surface and climate with the concomitant fauna and flora that reacts upon the ethnic life of the more primitive inhabitants of a given area.

The fact that so many linguistic stocks with the same culture are found in the same area is probably due to migration, for if a people do surmount the culture area barriers and survive they soon take up by imitation the habits of the older population, thus adopting the culture of the area. On the other hand, they retain their language and physical characteristics, which may be considered as habits of greater stability. The fact that California presents a culture area comprising a large number of linguistic stocks in contrast to the small number of stocks in other areas may be due to the physical barriers that have discouraged intermarriage and sociability, but not the dissemination of ideas or practical and religious knowledge. Thus the observed distribution of linguistic stocks is apparently not a contradiction to the assumption made in the foregoing.

Without attempting to enumerate all the factors that tend to isolate a culture area we may conclude that from a strict ethnic point of view types of culture are due to geographical isolation in concomitance with psycho-

physical conditions. We have based this discussion upon North American types because the physical aspect of the barriers are not so pronounced as in some other parts of the world and because we wished to emphasize the psychological aspect of these barriers. Although the writer knows nothing of the biological problem that has been discussed in these pages, he ventures to suggest that the habits of animals formed in response to environmental conditions may become psychological barriers to diffusion. There may be a kind of psychophysical at-home feeling that ties a species to certain areas.

CLARK WISSLER.

SPECIAL ARTICLES.

PHYSIOLOGICAL REGENERATION IN INSECTS.

MORGAN in 'Regeneration' (1901), p. 19, defines physiological regeneration as follows:

> Finally, there are certain normal changes that occur in animals and plants that are not the result of injury to the organism, and these have many points in common with the processes of regeneration. They are generally spoken of as processes of physiological regeneration. The annual moulting of the feathers of birds, the periodic loss and growth of the horns of stags, the breaking down of cells in the different parts of the body after they have been active for a time, and their replacement by new cells, the loss of the peristome in the protozoon, *Stentor*, and its renewal by a new peristome, are examples of physiological regeneration. This group of phenomena must also be included under the term 'regeneration' since it is not so sharply separated from that including those cases of regeneration after injury, or loss of a part, and both processes appear to involve the same factors.

Again, on p. 25 (*ibid.*), Morgan says that he will use the term physiological regeneration to include such changes "as the moulting and replacement of the feathers of birds, the replacement of teeth, etc.—changes that are a part of the life-cycle of the individual. In some cases it can be shown that these processes are clearly related to ordinary regeneration, as when a feather pulled out is formed anew without waiting for the next moulting period, and formed presumably out of the same rudiment that would have made the new feather in the ordinary moulting process."

Finally, on pp. 128–131 (*ibid.*), Morgan refers to the general fact that 'in the same animal certain organs may be continually worn away and as slowly replaced, and other organs replaced only at regular intervals,' and he lists a number of familiar instances of regularly recurring physiological regeneration, as the moulting of snakes, the throwing off of deer antlers and their renewing, and also the moulting of insects. As this is the only instance of physiological regeneration in insects mentioned by the author, and as it seems to be desirable to know, especially as a basis for any discussion of the relation between 'physiological regeneration' and the more familiar restorative phenomenon called simply 'regeneration,' of any other instances of physiological regeneration occurring among the lower animals—almost all the cited cases of physiological regeneration are among the vertebrates—I wish to point out briefly certain important and widespread phenomena in insect biology which should be included in the category of physiological regeneration processes. Indeed, Morgan specifically refers to the need of such further knowledge. "How far," he says, "physiological regeneration takes place in the tissues of the lower animals we do not know at present except in a few cases, but far from supposing it to be absent, it may be as well developed as in higher forms."

First may be mentioned the radical regeneration of the digestive epithelium of the ventriculus, common to all (?) insects, a phenomenon long known, albeit in a rather hazy way perhaps, to students of insect morphology, but in the last ten years carefully studied and satisfactorily worked out for a number of insect forms representing several widely separated orders. (See the papers of Mobusz, Rengel, Van Gehuchten, Needham and others.) This process consists of the constant senescence and complete degeneration of the nuclei and cytoplasm of the large epithelial cells of the ventricular portion of the alimentary canal and of the equally constant appearance of new nuclei in conspicuous small

groups or 'nests' near the basal membrane, their increase in size (growth) and migration toward the lumen, with an accompanying new formation of surrounding cytoplasm. The vigor of nucleus and cytoplasm seems to be exhausted after the secretion and discharge of a certain amount of digestive fluid, and rapid and perfectly obvious senescence and histolysis take place. Inspection of cross-sections of the ventriculus of any feeding caterpillar will show this normal physiological regeneration phenomenon in most illuminating manner. While this regenerative process was, when first noted, considered to be a part of that extensive general histolysis and histogenesis which regularly accompanies the post-embryonic development of insects with 'complete metamorphosis,' it is now known—thanks especially to Needham's discriminating work—to be a phenomenon also accompanying or incident to digestion, occurring all through the feeding life of the insect, and not limited to that period in late larval life (pre-pupal life) when the radical histolysis of the larval organs occurs, preparatory to, or coincident with, the new-building (histogenesis) of the imaginal (adult) organs. There is, however, probably always a marked and unusual degree of regeneration of alimentary epithelium during the prepupal and early pupal stages, *i. e.*, at the time of the radical transformation phenomena. This has been recently well shown in the case of the water-beetle *Cybister*, by Degeener.[1]

A more striking phenomenon, or group of phenomena, of physiological regeneration in insects is that extraordinary double process of degeneration and moulting on the one hand and regeneration and complete new-building on the other which characterizes the ontogeny (in post-embryonic life) of the insects with so-called 'complete metamorphosis,' *i. e.*, those insects which come from the egg in a form (larva) radically different from that of the definitive adult condition. From the butterfly's egg there hatches a caterpillar without wings, without compound eyes, with eight pairs of legs, with minute, short two- or three-segmented antennæ, with biting and chewing mouth-parts composed of heavy mandibles, jaw-like maxillæ, and flap-like labium, with musculature for worm-like and creeping locomotion, and with simple, straight alimentary canal for the manipulation and digestion of bits of solid food (leaves, etc.). But the butterfly into which the caterpillar develops has wings, compound eyes, long, many-segmented antennæ, only three pairs of legs, sucking mouth-parts composed of a curious long flexible tube made up of the maxillæ alone, with mandibles wholly wanting and labium reduced to a small fixed sclerite, complex musculature for flight, and a long twisted alimentary canal with conspicuous sac-like diverticula for holding and digesting flower nectar. In even greater degree do the larva and adult of the Diptera and Hymenoptera differ, and in only slightly less degree those of the Neuroptera and Coleoptera. Now in all these specialized insects the development from larva to adult (usually achieved in a few days or weeks) is not accomplished by a slow, gradual transformation of the parts of the larva into those of the adult, but is distinguished by the curious fact that many, if not most, of the larval organs are either wholly cast aside by moulting at the time of pupation, or undergo a radical histolysis resulting in complete disintegration. The larval mouth parts and antennæ are completely discarded at pupation (last larval moulting) and have their places taken by wholly new and usually markedly different mouth parts and antennæ; the larval musculation, parts or the whole of the alimentary canal, the salivary glands and Malpighian tubules, and parts or the whole of the tracheal system degenerate, and have their places taken by radically new muscles, alimentary canal, salivary glands, Malpighian tubules and tracheæ, produced (regenerated) from elementary cell groups called histoblasts or imaginal buds. This phenomenon of wholesale histolysis and histogenesis characteristic of all the members of all the orders of insects with complete metamorphosis (with some Coleoptera and some Neuroptera the breakdown and new-building is slight) is to be looked on as a wholesale and extreme case of

[1] *Zool. Jahrb.*, v. 20, pp. 499–676, 1904.

physiological regeneration. It is a normal part of the ontogeny of these specialized insects, but it is an interpolated, a cænogenetic condition. That is, although now a regularly recurring phenomenon in the life of these insects, it is distinguished only by the inevitableness and regularity of its occurrence from any occasional processes involving profound regeneration. It seems to me quite analogous with such cases of regularly recurring physiological regeneration as the moulting and new-growth of the plumage of birds, the casting off and new-building of the antlers of stags, the loss of the peristome and the formation of a new one in *Stentor,* etc.; in other words, with all those cases mentioned by Morgan in illustration of his definition of physiological regeneration.

In the two special cases of physiological regeneration in insects here called attention to, we may distinguish between regeneration of the ventricular epithelium from tissue (cells) of its same kind, and the regeneration of wings, legs, mouth parts and antennæ from cells not belonging to similar organs but simply forming part of the continuous larval derm. In this latter case of regeneration, too, the 'regenerated' parts are in all cases different from preexisting parts and in some cases (wings, for example) are wholly new parts. One might say that this is not regeneration at all, but simply development (ontogeny). But in numerous cases of true restorative regeneration the new parts do not agree exactly with the replaced ones; often they are markedly smaller, they lack segments, they lack many details; they are cases of teratogenesis. For example, the cockroaches (Blattidæ) have the capacity of regenerating lost legs, or rather parts of legs; but whereas the normal leg has always five tarsal segments, the regenerated one has always four. All regeneration may, of course, be looked on as a phenomenon of ontogeny; a regulation. In practically all animals which can regenerate at all, the capacity for regeneration is much greater in immature life than in adult life: in many, indeed, it exists only in the immature stages.

In connection with this brief reference to the occurrence of physiological regeneration in insects, it may not be amiss to refer, even more briefly, to our present knowledge of ordinary or what is called, for the sake of a provisional distinction between the two categories, restorative or accidental regeneration among insects. It has long been known that certain insects of incomplete metamorphosis, notably many Orthoptera, have the power of regenerating lost parts of legs, antennæ and certain other externally produced organs, as tracheal gills. Associated with this regenerative capacity occurs, in some insects, at least, self-mutilation or autotomy. In addition, it has also long been known that if the legs or antennæ be cut off from the larva of certain insects with complete metamorphosis (moths, beetles and others) the adult will appear with 'regenerated' legs or antennæ, sometimes perfectly normal in size and form, sometimes normal in form but reduced in size, and other times abnormal (usually lacking distal parts) in form. But, as I have already pointed out in a paper on the regeneration of the larval legs of silkworms,[2] this latter kind of 'regeneration' may not be restorative regeneration at all, but a phenomenon of physiological regeneration incident to the regular process of development of the imaginal legs, antennæ, etc., of insects of complete metamorphosis in the course of which the larval organs disintegrate and the imaginal ones get formed from histoblasts which lie in such position, at least in early larval life, as to be uninjured by any cutting of the larval legs. Finally, as I have shown in the paper just referred to, the larvæ of at least one species of moth, *Bombyx mori,* have the capacity of regenerating during larval life both thoracic (jointed) legs and abdominal (prop) legs. Tornier[3] also states that the larvæ of the meal worm, *Tenebrio molitor,* can also regenerate, before pupation, cut off legs, or parts of legs.[4]

[2] *Jour. of Exper. Zool.*, Vol. I., pp. 593–599, 1904.

[3] *Zool. Anzeig.*, Vol. 24, 1901.

[4] For accounts giving reviews and bibliography, in some degree of completeness, of the recorded cases of experiments and observations of regeneration, in insects, see Brindley, 'On Certain Char-

Because of the importance that regenerative phenomena have in the consideration of certain fundamental biologic problems, one might be tempted to try to find some significance in whatever special examples of regeneration happen to come under one's own observation. The relation between physiological regeneration and restorative regeneration is a subject very near at hand, if one were to look for something to speculate about in connection with what I have noted in this paper on regeneration in insects. But with Morgan, it seems to me that 'we do not gain any insight into either of the processes, so far as I can see, by deriving one from the other, for the process of restorative regeneration may be in point of time as old as that of physiological regeneration.' Indeed, among the insects we have good grounds for believing restorative regeneration older than the particular processes of physiological regeneration which regularly accompany the post-embryonic development of insects with complete metamorphosis. For these insects are admittedly the recent, the post-Tertiary, ones, while the Orthoptera, among which, especially, restorative regeneration is widespread and unusually well developed, are among the oldest of living insect orders. They make up the bulk of insects known from pre-Tertiary times. The most extensive and radical of physiological regeneration processes occur precisely among the most specialized, the most recent, insects.

Finally, as concerns the large question of whether regeneration is to be looked on as a certain primary, primitive, attribute of organisms whose manifestation becomes weaker as complexity in structure and function is attained (in course of descent), or whether, as is held by the Neo-Darwinians, it is to be looked on as an adaptation which has been transmitted through a long and many-branched course of descent, gradually weakening during this transmission until in the more complex organisms it is largely lost, although, in consonance with need, often retained even among higher forms, this is a question I shall refer to only in so far as to say that the evidence presented by all that we know of regeneration in insects, taken together, certainly does not warrant any such definite conclusion as Tornier expresses on the basis of his experiments with certain dragon-fly and May-fly larvæ, viz., that regeneration in insects is an adaptation produced by natural selection.

Vernon L. Kellogg.
Stanford University, Cal.

acters of Reproduced Appendages in Arthropoda, Particularly in the Blattidæ,' *Proc. Zool. Soc. London*, 1898, pp. 924–928; and Tornier, *Zool. Anzeig.*, Vol. 24, 1901, pp. 634–664.

A PRELIMINARY NOTE ON ASCUS AND SPORE FORMATION IN THE LABOULBENIACEÆ.

Concerning the systematic position of the Laboulbeniaceæ many opinions have been expressed. DeBary (1884) included them in his doubtful Ascomycetes; Thaxter (1895), of all best qualified to speak, referred them to the Ascomycetes; Karsten (1895) maintained that they were not Ascomycetes at all, but that they occupied a position intermediate between the smuts and the Pyrenomycetineæ, while Engler ('Syllabus der Pflanzenfamilien,' 1903) has elevated them to the rank of a class quite removed from both the smuts and the Ascomycetes. These differences in opinion have arisen from a lack of knowledge of the actual phenomena of spore production, a gap due to difficulties in obtaining and manipulating material suitable for cytological investigation.

In the course of recent investigations on the Ascomycetes I have given some attention to these peculiar and interesting forms, and an examination of microtome sections of well-preserved perithecia has revealed features that are apparently of undoubted significance in their bearing on the problem of the phylogenetic position of this group.

As for the spore sac, it has been discovered that each is primarily occupied by a fusion nucleus. Three successive nuclear divisions follow. The spore initials are delimited from an abundant epiplasm under the superintendence of the last generation of nuclei. The young spores are bounded by a plasma membrane, and the cavities in the epiplasm in which they lie are lined by a membrane of similar character. Indeed, the phenomena of

sporogenesis agree in all essentials with those already described for the Ascomycetes (Faull, 'Contributions from the Cryptogamic Laboratory of Harvard University,' LXI., in which there is a complete bibliography). Details and further researches in this group, which heretofore has not been subjected to microtonic methods, will be described in a forthcoming paper.

J. HORACE FAULL.

UNIVERSITY OF TORONTO,
December 2, 1905.

INBREEDING, CROSS-BREEDING AND STERILITY IN DROSOPHILA.

A SERIES of breeding experiments with the common pomace-fly, *Drosophila ampelophila* Loew., conducted during the past five years principally by my pupils and still in progress, has yielded certain results which it is the purpose of this note to summarize. A fuller account will soon be published elsewhere. Those who have taken part in the work are Thomas Ordway, Austin H. Clark, F. W. Carpenter, S. O. Mast, W. M. Barrows and myself. The part of each will be indicated in the final publication. The more important conclusions reached may be stated thus:

1. Inbreeding probably reduces very slightly the productiveness of *Drosophila,* but the productiveness may be fully maintained under constant inbreeding (brother with sister) if selection is made from the more productive families.

2. In crosses of a race of low productiveness and frequent sterility (race *A*) with a race of high productiveness (*B*) it has been found that a female of race *A* does not have her fecundity increased by mating with a male of race *B,* and conversely, a female of race *B* does not have her fecundity diminished by a mating with a male of race *A*. Hence every male not actually sterile furnishes an abundance of functional spermatozoa.

3. The cross-breds produced by the mating, *B* female $\times$ *A* male, are all of high productiveness.

4. The cross-breds produced by a mating *A* female $\times$ *B* male are usually, but not always of high productiveness.

5. The children of both sorts of cross-breds (see 3 and 4) are some of high productiveness like race *B,* others of low productiveness like race *A*.

6. Low productiveness is inherited after the manner of a Mendelian recessive character in certain of the crosses made, skipping a generation and then reappearing. In other cases it has failed to reappear in generation F_2, indicating its complete extinction by the cross. In a few cases it has failed to be dominated by high productiveness in generation F_1. In such cases the female parent has always been of race *A*. Hence low productiveness (or sterility) of the female may be transmitted directly through the egg from mother to daughter, but only indirectly through the sperm, the character skipping a generation.

7. A cross between two races, one inbred for thirty or more generations and of low productiveness, the other inbred for less than ten generations and of high productiveness, produced offspring like the latter in productiveness, but not superior to it.

8. The same two races crossed after an additional year of inbreeding (about twenty generations) produced offspring superior to either pure race in productiveness.

9. Inbreeding does not affect the variability in number of teeth on the sexual-comb of the male.

10. This character is closely correlated with size.

W. E. CASTLE.

ZOOLOGICAL LABORATORY, HARVARD COLLEGE,
January 11, 1906.

CURRENT NOTES ON METEOROLOGY.

AUSTRALIAN DAILY WEATHER MAPS.

IN 1904 the Public Schools Associations in New South Wales appealed to the Sydney *Daily Telegraph* to publish daily a weather map for Australia in order that the pupils in the schools might be given instruction in meteorology by means of the maps. The *Telegraph* thereupon applied to the Sydney Observatory for a daily chart, to be supplied not later than 2 P.M., in order that it might appear in the evening editions which reach the country in time for use in the schools the

next day. Since October 11, 1904, the daily weather map (isobars, wind direction and shaded areas of rainfall) has appeared regularly in the *Daily Telegraph*. The newspaper supplies the observatory with a small number of reprints of the maps each day, and through the courtesy of Mr. H. A. Hunt, acting meteorologist, New South Wales, the compiler of these notes has received a set of the maps bearing dates from May 24 on. We have no doubt that general interest in meteorology will be greatly stimulated by the publication of these weather maps in the *Daily Telegraph*. In the United States several papers have at odd times attempted a daily publication of weather maps. There is at present at least one newspaper, the Boston (Mass.) *Herald*, which still prints them regularly. A short account of 'The Newspaper Weather Maps of the United States' appeared in the *American Meteorological Journal*, Vol. XI., 1894–5, pp. 96–107.

METEOROLOGY OF THE 'SCOTIA' EXPEDITION.

R. C. Mossman, meteorologist of the *Scotia* Expedition, contributed to the August number of the *Scottish Geographical Magazine* a discussion of the meteorological results obtained after October, 1903, chiefly concerning the observations at Laurie Island, South Orkneys. The observations made at sea and at the Falkland Islands will be discussed later. The station at Laurie Island has, it may be remembered, been taken over by the Argentine Meteorological Service since February 22, 1904. One of the most interesting meteorological phenomena is the *foehn* winds. These come from the west-northwest over a considerable area of high land, and may produce as high a temperature in midwinter as in midsummer. Inversions of temperature were common during anticyclones. The summer is the cloudiest season, as is usually the case in the polar latitudes. The prevailing wind direction is northwest and west-northwest. Precipitation, chiefly granular snow, amounted in 1904 to 10.41 inches, although the actual fall may be fifteen inches. Thunder-storms occurred twice, and distant lightning was seen twice. The cyclones show a very rapid fall of the barometer in the front, and a slow rise in the rear. The rapid fall is associated with light winds, but heavy gales prevail on the rear.

LOSS OF SLEEP AND HIGH MOUNTAIN ASCENTS.

Dr. Bullock Workman, whose high mountain climbing in the Himalayas is well known, has recently brought out the point that very high ascents may be rendered impossible by loss of sleep due to the difficulty in breathing while lying down. He notes that while in camp at 19,358 feet his party was kept awake by lack of breath, and when the members dozed off, they would awake with a start, gasping for breath. Dr. Workman adds: "If camps could be established at heights of 23,000 feet to 25,000 feet and above, as they would have to be, sleep might be entirely prevented or interfered with by deficient oxygenation of the blood to such an extent that a party would be incapacitated from this cause alone from going any higher." (*Bull. Am. Geogr. Soc.*, XXXVII., 1905, 671.)

NOTES.

In *Symons's Meteorological Magazine*, September and October, 1905, R. H. Curtis urges the use of Beaufort's scale by observers on land who have not anemometers, and suggests that such observers would make much more accurate estimates of wind velocities if they accustomed themselves to associating the observable effects of the wind with the actual wind velocities, which could be published every day.

The crop of meteorological observations made during the recent solar eclipse is beginning to be gathered in. Among the data published we note the following: At Falmouth (England) the thermograph showed a slight depression at 12:30 P.M., and the fall continued slightly until 1:15 P.M., well after the maximum phase. The barometer rose throughout the day, with a little more pronounced rise between 1 and 2 P.M., but no irregularities were noted. At Broughton-in-Furness a decline of temperature was distinctly shown, from nearly 60° at noon to 56°

at 1:15 P.M., when a rise began, giving 60° again at 3 P.M.

WE learn from *Symons's Meteorological Magazine* (November, 1905) of the establishment of a lectureship on meteorology in the University of Manchester. Mr. George C. Simpson, who occupies this position, is the first university lecturer on meteorology in Great Britain.

R. DEC. WARD.

THE NEW ENGLAND INTERCOLLEGIATE GEOLOGICAL EXCURSION, 1905. GEOLOGY OF THE NANTASKET AREA.

THE New England Intercollegiate Geological Excursion for the year 1905 was held at Boston, on Saturday, October 28, under the auspices of the Massachusetts Institute of Technology. Professor T. A. Jaggar, Jr., was in charge, Professors J. B. Woodworth, of Harvard, and D. W. Johnson, of the institute, cooperating in the work.

On Friday evening, October 27, an informal conference was held in the library of the department of geology at the institute, the meeting being well attended. Professor Jaggar outlined the plans for the following day, and presented a brief account of the geological history of the Boston Basin, together with a more detailed description of the lava flows, dykes and sediments of the Nantasket area. Professor Johnson followed with a discussion of the recent changes which have taken place in the drumlins and beaches of the harbor, particularly those which have affected the development of the present Nantasket Beach.

The party, consisting of forty-five teachers and students, left South Station at 8:43 Saturday morning, going by train to Point Allerton at the northern end of the beach. After noting the different stages of marine erosion shown by the remnants of the Allerton drumlins, the party walked southward along the old abandoned beaches which were formed a considerable distance west of the present shore. The consecutive stages in the development of the present form of Nantasket could be made out from the succession of beaches with intervening 'slashes,' converging at the north to pass a little south of Point Allerton Hill (drumlin), and indicating a former seaward extension of the beaches; and converging at the south to join the northern side of the Strawberry Hill drumlin. It was seen that the smaller waves from the protected harbor are now cutting into these older beaches from the west, destroying the work accomplished by the larger Atlantic waves in a former time, and building out to the northward a much smaller beach made up largely of the material eroded from the older beaches. The presence of a peculiar protuberance in the outline of the western shore was shown to be due to the former existence of a drumlin at that place, the drumlin having been removed largely by marine action, but partly by man. The splendid example of an abandoned marine cliff on the southeast side of the Strawberry Hill drumlin, the prominent crescentic cliff in the next drumlin well to the south, and numerous minor 'nips' in the several drumlins, indicate successive positions of the eastern shoreline as the different beaches were added without any apparent change in relative elevation of the land, and point to the probable existence of former drumlins which profoundly influenced the development of the beaches, but which have since been destroyed by the waves. The general features of this succession were called to the writer's attention by Professor Davis, of Harvard, and the detailed study of the region forms the subject of a paper which will be presented at a future time.

After the study of the old beaches and abandoned marine cliffs the party divided into two sections, one division under the direction of Professor Jaggar, the other under that of Professor Woodworth. The detailed structure of the Nantasket ledges of south-dipping conglomerates, slates, lavas, breccias and sandstones were pointed out, and the origin of the most interesting features discussed. Intersecting dykes of diabase, sometimes containing inclusions of the underlying granite, sometimes almost entirely removed from between the hard walls of country rock by the action of the waves, afforded many points of interest. The 'volcanic bombs' in the melaphyr, and the extensive beds of conglomerate contemporane-

ous with the lavas and tuffs, make an exceptionally complete ancient volcanic section. The fault phenomena of the region were considered, especially the effect of the major east-west faults in bringing the underlying granite up in contact with the sedimentary and volcanic series, and in preserving the higher members of the volcanic series.

Dinner was provided at one of the hotels near the beach, through the courtesy of the departments of geology of Harvard and the institute. At 3:40 in the afternoon the steamer was taken at the Nantasket pier, the boat ride up the harbor giving a good opportunity to see the cliffed drumlins which constitute the greater part of the harbor islands.

The largest delegation to the excursion came from Williams, Professor Cleland bringing a party of fifteen of his students. Among the other institutions represented were Mt. Holyoke, Smith, Radcliffe, Yale, Brown, Tufts, Boston College, Harvard and the Institute of Technology. D. W. J.

THE CARTWRIGHT LECTURES AND BARON TAKAKI.

THE Cartwright lectures of the Alumni Association of the College of Physicians and Surgeons of New York will be given on Thursday, January 25, Monday, January 29, and Friday, February 2, by Baron Takaki, on 'Military and Naval Sanitation, Experiences drawn from the late Japan-Russia War.'

Dr. Takaki belongs to one of the Samurai families of the Satzuma clan, as do his contemporaries, Generals Oyama, Kuroki, Nogi and Nodzu and Admirals Togo and Kamura. During his youth he was sent by his government to study medicine in England, where he graduated with honor from St. Thomas' Hospital School, studied the sanitary system of the British Navy, and passed examinations for the degrees of F.R.C.S. and F.R.C.P.

On his return to his native country he directed his chief attention to the reformation of the sanitary and medical systems of the newly born navy of Japan. It was not only reorganization that he accomplished, but the creation of an entire medical equipment and medical sanitary service for the Japanese navy. He was rapidly promoted to the rank of surgeon general of the navy, which position he held until the time of the Japan-China war. As a recognition of his great services rendered to the emperor and his country he was created a baron after the conclusion of that war. At present he is in the naval reserve.

During his active service in the navy, Baron Takaki initiated and carried out certain fundamental changes in the dietary and sanitary regulation of the navy which resulted in the almost total suppression of beriberi, which, up to that time, had seriously impaired the efficiency of the service, affecting annually almost one quarter of the navy's personnel. Baron Takaki has also been president of the Naval Academy of Japan, president of the Tokyo Charity Hospital, councillor of the Association of Sanitary Improvement of Japan, and has held other important positions. He has been active in spreading the principles of the Red Cross Society in Japan, and it is to his efforts that the large number of Red Cross members in that country is chiefly due.

Baron Takaki has received the honorary degree of doctor of medicine of the Japanese government, a degree issued only by the Department of Education, and not the same as the degree of M.D. conferred on the graduates of the university. He is a member of the house of peers of the parliament of Japan, having been directly nominated by the emperor.

THE SIXTH INTERNATIONAL CONGRESS OF APPLIED CHEMISTRY.

THE Sixth International Congress of Applied Chemistry will assemble at Rome, on April 16, Easter Monday, 1906. It is important that delegates who expect to be in time should sail not later than April 1.

The Italian steamship line, La Veloce, 29 Wall Street, New York, offers first-class passage from $55 up to Genoa or Naples. The agent indicates that a party of delegates may secure superior quarters at minimum rates if sailing together.

The Italian Royal Steamship Co., 11 Broad-

way, New York, offers berths at the lowest rates, provided that it is informed in time to write to the Home Office to obtain concessions.

The Hamburg-American Line, 35 and 37 Broadway, New York, offers berths as follows: On the *Moltke*, $90 and up, on the *Hamburg*, $85 and up, and on the *Prinz Oskar* and *Prinz Adalbert*, $75 and up. They say that if a party should sail at a time when the steamers are not crowded: 'We shall be glad to give them better accommodations than the above rates call for.' Particulars of sailing can be obtained by addressing any of the offices above mentioned.

The organization of the society into sections is set forth in this JOURNAL for July and August, 1905, pages 66 and 72, respectively, of the proceedings.

Intending members may send their subscriptions, twenty francs, directly to Professor E. Paterno, or may send a check for four dollars ($4) to the undersigned, who will forward the amount of the subscription to Rome.

American chemists intending to become members and send papers are urged to act without delay. Papers should be typewritten on thin paper and may be sent directly to the secretary or to the undersigned at Washington, who will undertake to forward them. The section before which the paper is to be read should be specified. It is suggested that the typewritten copy be carefully revised by the author to see that it is in form for printing, as the Italian authorities will follow the copies implicitly in printing the reports, and thus avoid all possible errors.

The Italian railways offer a reduction of sixty per cent. on first-class rates to all members of the congress who may wish to use the railways while in Italy.

Forty subscriptions have already been forwarded by the chairman of the committee, and many others have sent their subscriptions directly. At the present time it appears that fifty or sixty members of the American chemists have become members of the congress. It is to be hoped that a much larger number may be secured.

The chairman of the American committee urges upon intending members the desirability of preparing papers for the congress, in order that American chemistry may be as well represented in this congress as it was at the last one in Berlin.

This will be the final notice published concerning the congress unless some additional instructions be received from the Italian committee.

H. W. WILEY,
Chairman of the American Committee.

SCIENTIFIC NOTES AND NEWS.

WE learn from the 'Year Book of the Carnegie Institution,' just published, that Mr. Alexander Agassiz has resigned as trustee of the institution and that Dr. R. S. Woodward, the president, has been elected a trustee to fill the vacancy. The vacancy in the board caused by the death of John Hay has not been filled. Dr. Charles D. Walcott has resigned the secretaryship of the board and is succeeded by Mr. Cleveland H. Dodge.

THE Nichols medal of the American Chemical Society for the year 1905 has been awarded to Professor Marston Taylor Bogert, of Columbia University, for his researches on the quinazolines. The medal will be formally presented at the meeting of the New York Section on February 9.

PROFESSOR A. PEDLER, F.R.S., director of public instruction in Bengal, has been knighted by King Edward.

DR. ADOLF LIEBEN, professor of chemistry at Vienna, has been awarded the Lavoisier medal of the Paris Academy of Sciences. He has also been elected a foreign member of the Accademia dei Lincei, Rome.

THE Lagrange prize of the Belgian Academy of Sciences has been awarded to Professor Hecker, of the Geodetic Institute at Potsdam.

DR. WALTHER NERNST, professor of physical chemistry at Berlin, has been elected a member of the Berlin Academy of Sciences.

DR. DANIEL OLIVER, F.R.S., emeritus professor of botany in the University of London, has been elected an honorary member of the Royal Society of New South Wales.

THE past and present house officers of the Johns Hopkins Hospital are to have a life-

size portrait painted of Dr. Henry M. Hurd, superintendent. It will be hung in the administration building.

The fishery steamer *Albatross* will soon proceed on an extended cruise to the western Pacific for the purpose of conducting scientific and fishery investigations in the interest of the Bureau of Fisheries. The principal work will be done in the Japan seas. Dr. David Starr Jordan will be in immediate charge.

Professor Hele-Shaw has returned to England from South Africa, where for the past two years he has been engaged in organizing technical education.

The State Bacteriological Laboratory, authorized by the Connecticut General Assembly, has been opened at Wesleyan University under the direction of Mr. James A. Newlands.

Dr. Walter Remsen Brinckerhoff, assistant pathologist at the Harvard Medical School, has been appointed pathologist in charge of the new hospital and laboratory for the study of leprosy on the island of Molokai, Hawaii.

Dr. James H. Hyslop, of New York City, has been offered the secretaryship of the American branch of the Society for Psychical Research, vacant by the death of Dr. Richard Hodgson.

Professor W. D. Taylor, professor of railway engineering in the University of Wisconsin, has resigned to become chief engineer of the Chicago and Alton Railroad.

Dr. Otto Nordenskjöld spoke in the geological lecture room of Harvard University, on January 12, on the scientific results of the Swedish Antarctic expedition, 1901–1904, of which he was the leader, making special reference to the fossils of late Mesozoic and Tertiary formations from which large collections were secured. On the evening of January 13, Dr. Nordenskjöld was the guest of the Harvard Travelers Club at a house meeting in Boston, where he gave a general narrative of his Antarctic voyage.

On February 21 there will be a civil service examination for the positions of plant pathologist and entomologist in the Experiment Station at Porto Rico, and also for the position of statistical expert in the Geological Survey. The salaries of these positions are $1,200.

In accordance with the recommendations of Professor John B. Smith, a bill has been introduced into the New Jersey legislature appropriating $70,000 a year for five years for the extermination of mosquitoes.

The Carnegie Museum has acquired by purchase the valuable and extensive collection of shells made by Dr. Victor Sterki, of New Philadelphia, Ohio. The collection contains a great many types and cotypes.

The department of ethnology of the American Museum of Natural History has received as a gift from George S. Bowdoin, Esq., a member of the board of trustees, a valuable collection illustrating the culture of some of the tribes of Central Africa. The collection includes implements of warfare, idols, fetiches and masks, clothing, baskets and musical instruments, household utensils of bamboo, pottery and brass, bracelets, necklaces and household adornments of beads, shells and brass. A large gold bead weighing three ounces and seven carved ivory tusks from Ashantee are worthy of particular mention.

The cornerstone of the High Altitude Laboratory, proposed by Professor Angelo Mosso, has been laid on the col d'Ollen, 3,000 meters above the level of the sea. The Italian, Belgian, German and Austrian governments have contributed towards the cost of erection. It is expected that the building will be completed in 1907, and will be open to men of science of all nations in 1908.

We learn from the London *Times* that the Institute of Archeology of the University of Liverpool has despatched an expedition to make explorations and excavations in the vicinity of Esna, in Upper Egypt. The funds have been privately subscribed by Liverpool citizens. The excavations will be under the charge of the university reader in Egyptian archeology, Mr. J. Garstang, assisted by Mr. E. Harold Jones. A third member of the staff of the

same institute, Mr. Percy E. Newberry, is already at work in Egypt upon the history of the ancient civilization of that country, under the endowment of Sir John Brunner.

THE New York *Medical Record* states that according to recently published statistics, the number of medical students has been steadily decreasing in Germany. In the year 1902–3 the total number of aspirants for medical degrees in all the German universities was 6,232, which was the lowest figure noted in about twenty years. The maximum was reached in 1887–8, when 8,513 medical students were enrolled. In 1890–1 the number of medical students to 1,000 students in all departments was 296; in 1902–3 the proportion was only 178. In 1892–3 more students chose medicine than any other profession, but ten years later both philosophy and law were more popular.

THE highest recorded velocity of underground waters has been discovered by Mr. H. C. Wolff, of the department of mathematics of the University of Wisconsin, in the course of an investigation which he carried on in Arizona during the Christmas holidays. The rate of movement of underground water in gravels near Tucson he found to be 144 feet in twenty-four hours, while the highest previously rated by observers was only about 100 feet. Mr. Wolff was commissioned by the chief hydrographer of the United States Geological Survey to spend the Christmas recess giving instructions to the members of the engineering department of the University of Arizona in the methods of measuring the rate of movement of under-flow streams. The University of Arizona is carrying on this work for the purpose of developing the water resources for irrigation in the neighborhood of the city of Tucson.

THE inaugural address of the Manchester Literary and Philosophical Society was delivered, on October 17, by Sir William H. Bailey, the president of the society. The address, according to the abstract in *Nature*, took the form of an interesting historical account of the society since its foundation in 1781, and included appreciative references to the work of many distinguished members whose names are to be found in early volumes of memoirs. The founders were the chief scientific men of Manchester. Among the honorary members were Erasmus Darwin, Dr. Franklin, Lavoisier, Dr. Priestley, William Roscoe, of Liverpool, the poet and grandfather of Sir Henry Roscoe, Dorning Ramsbottom, Josiah Wedgwood and others. The chief tools of the workshops of the world, not only those where steam engines, locomotives and steamships are built, but also of the textile factories of the world, were invented in Manchester or within thirty miles of it. The records of the society contain the names of many of these inventors who were members, for the men of Lancashire were the first to use steam power for spinning and weaving, and for punching, cutting and shaping metal. Prominent among the inventors was that genius Richard Roberts, who was always in the front rank in advocating technical education. His chief inventions were the slide lathe, planing machine and self-acting mule for spinning cotton. Then there was Nasmyth, the inventor of the steam-hammer, Sir William Fairbairn and Sir Joseph Whitworth. Finally, Sir William Bailey referred to the great work of the illustrious members Dr. Dalton and Dr. Joule, whose effigies in marble are in the entrance to the Manchester Town Hall.

DR. LUDWIG MOND has written to the vice-chancellor of Cambridge University: "I understand that a fund exists for the augmentation of the endowment of the Stokes and Cayley university lectureships in mathematics, and that the object of such fund is to set free the time of two distinguished resident mathematicians for the promotion of advanced mathematical science by public teaching and research. I further understand that the income of such fund will in about three years' time be reduced by £300 a year. I have the pleasure in enclosing herewith a check for £1,750, which I trust will enable the lectureships to be maintained by the university for a further period. I desire that this sum should be separately invested and the income thereof accumulated until the time when the

income of the said fund shall become reduced as above mentioned, and that from and after that time the investments representing the said sum and accumulations should from time to time be applied so far as they will extend in augmenting the income of the said fund to the extent of £300 a year. Further, that if from any cause the lectureships or either of them should cease to be maintained, the said investments or such part thereof as shall not have been then applied as aforesaid should be applied for the promotion of advanced mathematical science and research in the University of Cambridge as the vice-chancellor for the time being of such university shall in his absolute discretion determine."

UNIVERSITY AND EDUCATIONAL NEWS.

Mrs. Isabella Elder has bequeathed to the Glasgow and West of Scotland Technical College £5,000 to provide for a course of popular lectures on astronomy.

The new entomological laboratories of the University of California, which are under the charge of Professor C. W. Woodworth, were dedicated in connection with the joint meeting of the State Teachers' Association and State Farmers' Institute, on December 27. The building is 38 x 44 feet and is three stories high, besides attic and basement. During the past year there have been over 400 students enrolled in the department.

The annual report of the treasurer of Harvard University shows that the funds of the university, up to July 31, 1905, amount to $18,036,025.71, which is an increase over last year of $1,280,271.61. The largest item of the new funds is $736,225.28, which is the amount of the teachers' endowment fund which had been turned over up to July 31, 1905. The amount of the fund is $2,240,000, of which already $1,800,000 has been paid in. The deficit in the university, college and library accounts for the year was $30,743.06, or about $5,000 less than last year. The deficit did not cause the incurrence of any debts as it was charged to the principal of the insurance and guaranty fund, thus reducing the amount of income yielding capital. There will be a large measure of relief, however, from the new unrestricted funds and from the increased income from the new system of tuition charges. In the medical school there was a deficit of $24,853.93, which reduced the credit balance to $5,560.57. The accounts of the Arnold Arboretum show a surplus of $9,855.39.

Dr. Joseph Erlanger, associate professor of physiology in the John Hopkins University, has been appointed professor of physiology in the University of Wisconsin. In the same institution Dr. E. A. Ross, of the University of Nebraska, has been made professor of sociology, and Dr. A. C. McLeod, of the University of Chicago, instructor in soils. Dr. W. S. Marshall has been appointed to an associate professorship of entomology.

Dr. Caswell Grave, Ph.D., has been appointed professor of biology and director of the Biological Laboratory of the Woman's College of Baltimore in place of Dr. Maynard M. Metcalf, resigned. Dr. Grave is a graduate of Earlham College (B.S.) and of the Johns Hopkins University (Ph.D.). At the latter university he has been scholar, fellow, Adam T. Bruce fellow, assistant demonstrator and is now associate in zoology. He was for one season on the staff of instruction of the Marine Biological Laboratory at Woods Hole and has for four seasons been director of the Bureau of Fisheries Laboratory at Beaufort, N. C.

Dr. Florence Peebles has resigned her position as associate professor of botany at the Woman's College of Baltimore, to give all her time to zoological research. Forrest Shreve, Ph.D., has been appointed in her place. Dr. Shreve is a graduate (A.B. and Ph.D.) of the Johns Hopkins University, where he was scholar and fellow and is now Adam T. Bruce fellow in botany. He is at present on leave of absence studying at the Cinchona Botanical Garden in Jamaica.

Professor Albrecht Penck, of Vienna, has accepted the professorship of geography in the University of Berlin, vacant by the death of Professor von Richthofen.

Dr. K. Dietrici, of the Hanover Technological Institute, has been called to the chair of physics at Rostock.